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OF THE
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The Journal

OF THE
Ministry of Agriculture

MARCH, 1920.

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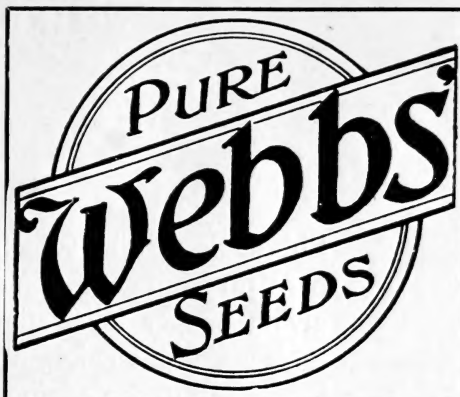
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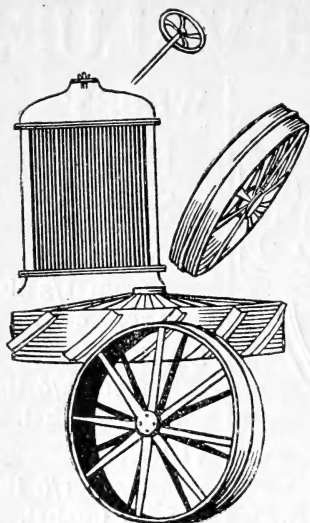
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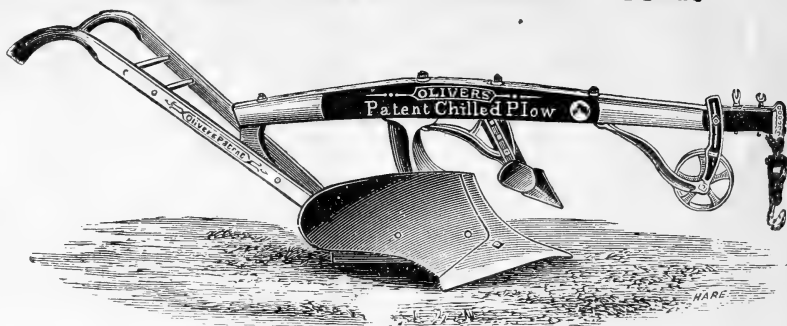
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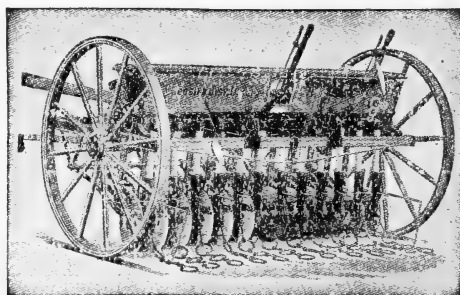


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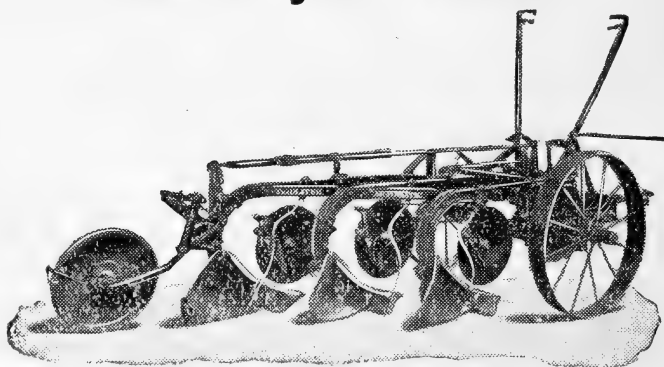
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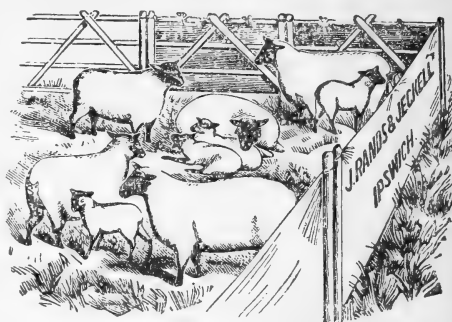
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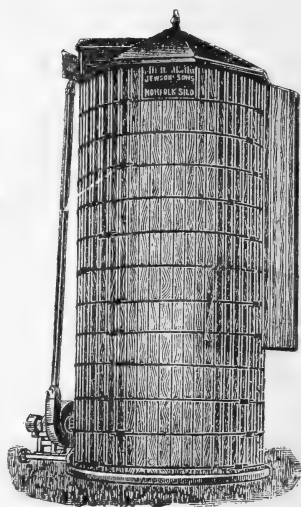
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OF THE

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Vol. XXVI. No. 12.

MARCH, 1920.

NOTES.

Two important announcements in regard to the prices of wheat harvested in 1920 and in 1921 have been made by the Government.

* * * * *

THE Prime Minister, in the House of Commons, on the 12th March, said :—

**Price of the 1920
Wheat Crop.**

“ In order to remove the anxiety which has been expressed by farmers with regard to the price of the 1920 wheat crop, the Government has decided that, so long as wheat is still controlled and thereby deprived of a free market, the controlled price of home-grown wheat of sound milling quality, harvested in 1920, shall be the monthly average (c.i.f.) price of imported wheat of similar or comparable quality, provided that the price so paid to the home grower shall not exceed 95s. per qr. of 504 lb.”

* * * * *

WITH regard to the price for the 1921 crop, the following announcement has been approved by the Cabinet :—

**Price of the 1921
Wheat Crop.**

“ It is hoped that before the Autumn of 1921 the importation and control of the price of wheat by the Government will have ceased, and that farmers will secure the benefit of a free market at world's prices.

So long as wheat is still controlled, and thereby deprived of a free market, the controlled price of home-grown wheat of sound milling quality, harvested in 1921, will be the average (c.i.f.) price for the twelve months ending 31st August, 1921, of imported wheat of similar or comparable quality, provided that the price so paid to the home grower shall not exceed 100s. per qr. of 504 lb.”

THE Cabinet has come to two other decisions with regard to the control of agricultural produce. The great decline in the pig population of the United

Decontrol of Pigs. Kingdom, which has been one of the unfortunate results of control of both market and price, is a matter of national concern. It has not only injured the agricultural industry but has made the consumer increasingly dependent upon imported bacon, which is not agreeable to his taste. With a view, therefore, to stimulating the breeding of pigs, and a supply of fresh pork and bacon for the British consumer, the Cabinet has decided that *home-grown pigs and pig products shall be decontrolled from 31st March.*

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THE Government had also been prepared to decontrol all other home-grown meat on 1st February, and has been strongly urged in this direction by the

Decontrol of Home-grown Meat.

National Farmers' Union, the Royal Agricultural Society, and other responsible bodies representing the English and Welsh farmers. Vehement objection, however, in the removal of control was taken by the Scottish and Irish farmers, and, although the Cabinet was of the opinion that decontrol would have operated to the advantage of both producer and consumer, it was felt that it would be better to forego that advantage, rather than to give any excuse for a charge of breach of faith which might shake the confidence of the agricultural community in the undertakings of the Government. The existing control of home-grown meat will therefore continue until 4th July, when a free market will be restored.

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SOON after the Armistice it was decided to bring the Government Tractor and Horse Schemes to an end. It was realised, however, that the transition from public

Tractor and Horse Schemes.

to private ownership could only be effected gradually. The Government necessarily had to execute the contracts in hand and provide for those farmers who were relying upon State assistance for the coming year. Consequently, only a few tractors and horses were sold before the completion of the 1919 spring cultivations, a sufficient force of tractors and horses being retained to assist those farmers who would otherwise have been

unable to carry out the work until the harvest was gathered. One or two counties had nearly a full complement of tractors for the whole period ; some were able to dispense with any further help after the spring cultivations ; others retained horses and dispensed with tractors.

The process of liquidation has thus been drawn out for more than a year, but is now practically completed. All horses have been sold, and only a few tractors and implements remain on hand for disposal. All tractors worth repairing were put in running order before the sales, which were held in the localities where they had been working. Horses were carefully "vetted" before being sold. The interval between the use of tractors and horses under the Government Scheme and their use in private ownership was thereby made as short as possible. That these measures were successful is shown by two facts :—(1) high prices were realised at the Government sales—in some cases more than the original cost ; and (2) there was an almost entire absence of complaints, although it was anticipated that a certain amount of hardship in individual cases would result when the Government Schemes came to an end.

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UNDER the Ministry of Agriculture and Fisheries Act, 1919, the County Agricultural Committees which are to be formed are charged with the duty of making County Agricultural Committees and Village Life. "such inquiries as appear to them to be desirable with a view to formulating schemes for the development of rural industries and social life in rural places, and for the co-ordination of action by local authorities and other bodies by which such development may be affected." The Committees are enjoined "to report the result of such inquiries to the Ministry and to any local authority or body concerned, and the expenses incurred by the Committee under this sub-section, to such amount as may be sanctioned by the Ministry with the approval of the Treasury, shall be defrayed by the Ministry."

These Committees are thus given an important duty to perform, and if they address themselves to it with ardour and determination, they will do a great deal towards brightening and enriching village life. Apart from the starting of new rural industries in suitable localities, efforts are called for to induce manufacturers, whose goods can be made in the homes of cottagers, to open branches of their factories in rural areas.

In Dorset and Somerset there is a great deal of net braiding and gloving in cottage homes, and probably other manufacturers could get work done quite reliably by taking it to the people, instead of bringing people from rural districts to work in large and already congested areas of population. It is not, of course, suggested that competitive forms of labour are required in the country; occupations are sought which may afford employment to the women and young girls. Experience has shown that if the latter migrate to the towns, the youths follow. If, therefore, employment can be found for the girls, something will be done towards checking the movement from field to factory which has, of late years, been so unfortunate a feature of our national life.

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THERE is still a certain amount of criticism made as to the measures being taken to check the spread of Wart Disease.

Wart Disease. In these circumstances it is well that the official attitude should be understood.

In the first place, it is important that clean parts of the country should be protected from infection. Were they to become badly infected, the existence of immune varieties would still suffice to save the potato-growing industry carried on there, but an immediate stop would be put to the cultivation of those varieties eminently suitable to local conditions. For example, in the Fen country, the "King Edward" and "Evergood," both unfortunately susceptible to Wart Disease, grow better than any others. Moreover, there is a very large demand for them all over England, with the exception of certain districts in the Ridings of Yorkshire and in the South-Western counties. Even in these districts, in which there is no marked local demand, large quantities of "King Edward" are grown to meet the demand elsewhere.

The Ministry has come to the conclusion that the main cause of the spread of Wart Disease is the planting in clean areas of susceptible varieties of potatoes obtained from infected or suspicious districts. Their policy has, therefore, been not only to make it illegal to use as seed for clean land potatoes which have been grown on infected land, but also to limit the cultivation of potatoes on infected land to immune varieties. The latter regulation has certainly prevented the wide distribution of disease that would have been entailed by the common practice of using ware potatoes as seed, but it has also involved some hardship on the grower for market by

preventing the cultivation of certain susceptible varieties which in his opinion are best suited to his land and to his markets.

Were the planting of susceptible varieties in infected and suspicious districts to be allowed, the free distribution of the crop for any purpose would involve a grave manacle to clean areas, and distribution would have to be restricted to markets in districts already infected. This interference with the trade in *ware* potatoes might inflict more hardships upon growers in infected districts and cause more discontent among consumers than does the present policy.

No alteration of the Regulations is contemplated during the forthcoming season, but the Technical Advisers of the Ministry are giving full consideration to the question of the possibility of any alternative policy, which might, without introducing other hardships, dispense with those at present entailed, and so be acceptable to the potato industry generally.

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THE total area of land acquired to date by the Ministry for Farm Settlements for ex-Service men is 25,693 acres, comprising 15 different properties. Vacant possession of the land will be obtained as follows:—Already obtained, 14,480 acres; by Michaelmas, 1921, 6,348 acres; subsequently, 4,865 acres.

On the profit-sharing settlement at Patrington, which was the first estate acquired, 63 ex-Service men are now employed, 37 of whom have completed their 6 months' probationary period, and are, therefore, entitled to share in the profits on the farming operations. The development of the small holding settlement at Holbeach is also in an advanced stage, as 75 small holdings have already been let to ex-Service men, and a further 7 men are working on probation on the central farm. The small holders on this settlement have formed a co-operative society affiliated to the Agricultural Organisation Society. Although possession of the estate at Titchfield was obtained only on 29th September last, there are now 78 ex-Service men with small holdings, and 38 others employed on the central farm or on the estate work. The principal crop at this settlement is strawberries, as the estate is situated in the strawberry-growing district of Hampshire. A Co-operative Society has just been formed.

The settlements at Bosbury and Wantage are being specially set apart for ex-officers. At the former, there are at present 7 ex-officers with small holdings and 2 employed on the central farm, and at the latter 8 ex-officers working on the profit-sharing farm. At Wantage, 12 ex-land army women are also working on probation. The Ministry is endeavouring to increase the number of openings available for women who have served in the forces or have been engaged on agricultural work during the War, and it is hoped to take a small number of women at each of the settlements.

A fine agricultural estate at Sutton Bridge (Lincs) has been purchased from the governors of Guy's Hospital. It covers 6,542 acres, practically arable land, alluvial in character, and of a most fertile nature, eminently suitable for intensive cultivation and capable of producing heavy crops of potatoes, fruit, and other market-garden products. It is ripe for closer settlement and offers a unique opportunity for the development of small holdings on co-operative lines. No ex-Service men have yet been settled on this estate, as vacant possession of the first portion of the land will not be obtained until April next.

The Ministry has also purchased an estate at Wainfleet (Lincs) comprising 1,778 acres. It will provide about 30 small holdings of from 30 to 40 acres in extent suitable for mixed farming, the Ministry retaining a portion of the land for a central farm. About 250 acres of the estate will come into hand at Lady Day next, and the remainder at Michaelmas.

The total number of ex-Service men who have been received at the settlement is 536, of whom 84 have left for reasons of ill-health, etc., leaving 452 at the settlements at present. This number is made up of 271 settlers, 107 probationers, and 74 other ex-Service men working as wage-earners. The settlers consist of 200 men provided with small holdings, and 71 men on profit-sharing farms who have completed their six months' probationary period. The small holdings provided comprise in all 1,971 acres. In addition, 12 ex-land army women have been settled at the Wantage Farm Settlement which is devoted to dairying, and 1 at the Pembrey Farm Settlement in South Wales.

Progress with the development of all settlements has been greatly hindered by difficulties of housing accommodation. The estates when purchased are equipped only with the number of houses and cottages necessary for extensive farming, and

many of them are in a bad state of repair. In addition to new cottages, considerable repairs and alterations to existing buildings have been necessary. In several instances army huts have been erected and used as hostels until other accommodation is available. At each of the settlements at Amesbury and Rolleston 2 army huts have been erected as bungalows for married men and their families. Thirty-six and 56 new cottages have been completed by the Ministry at Patrington and Holbeach respectively, and are now occupied by settlers and their families. Sixteen cottages are in course of erection at Pembrey, 14 at Rolleston, and 25 at Amesbury. At Amesbury, 9 new cottages are now nearly ready for occupation.

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EXPERIMENTS on the soiling of milch cows have been carried out at the Harper Adams Agricultural College since 1915.

**The Harper
Adams
Soiling Experiment.**

The first experiment was designed to test the possibilities of producing the green food for stock usually supplied by grass during the summer months. The results may be said to have shown that, with a proper rotation and suitable succession of crops, arable land possesses a great advantage over even the richest grass in ability to maintain a large head of stock per acre. This investigation has been continued with a view to testing the possibility of maintaining dairy cows entirely on arable land throughout the year. It is a method which is little practised in British farming, but the results have proved the complete success of the system, for winter as well as for summer fodder.

The result of the whole series of experiments shows that milk production on arable land can be practised with success and with every prospect of profits equivalent to those obtained in other systems of farming. Cost of labour per gallon of milk is not greater with the soiling system than with other methods of farming. Much labour usually employed in ordinary farming is dispensed with; the crops are cheap to grow, and can be fed without chaffing or pulping; in addition, the system lends itself to a more perfected organisation than is possible in the usual method of farming.

The plan of working was as follows. A field of the lightest sandy soil was sown as early as possible with a mixture of peas and oats to provide hay for the winter months. For the production of green fodder a field was set apart and divided

into eight plots, each plot producing forage to supply 10 cows 14 to 21 days. Such an arrangement provided a continuous supply of fresh green fodder throughout the summer. Five of the eight plots were ploughed up and planted with cabbage immediately the first crops were off the ground, that is to say, at intervals from May to September, the remaining three plots being sown with mixtures in the autumn to provide the first crops for the following year. The soiling succession of crops on the eight plots was mixtures of the following:— (1) giant rye, winter vetches; (2) giant rye, field peas; (3) winter oats, winter barley, winter vetches; (4) wheat, winter vetches; (5) oats, field peas; (6) barley, field peas, vetches, field beans, oats; (7) oats, field peas; and (8) maize.

During the summer period the green fodder crops were fed to the cows, with the addition of pea and oat hay; the second crops, viz., cabbages, were fed from October to February, in conjunction with pea and oat hay, and, finally, mangolds and pea and oat hay were used from February to May.

The cows kept in good condition on the food, and gave high yields of milk when consuming only 70 lb. of fodder per head per day, while it was found that, in the case of certain crops, they would eat as much as 120 lb. per day. From 80 lb. to 90 lb. seems to be all that is actually required under ordinary circumstances. When fodder is abundant it is advisable to give the cows all they will eat.

As regards yields of milk, in the summer of 1917 499 gal. were obtained per acre, as against 198 gal. from similar land in grass. In 1918 13 cows kept on the system throughout the year consumed the produce of $15\frac{1}{2}$ acres, including 7 acres of pea and oat hay and 1 acre of mangolds. Cake and meal at the rate of 4 lb. per head per day were supplied in addition. The yield of milk per cow during the year worked out at 625 gal., and 548 gal. per acre for the land involved.

The experiments appear to show that a succession of fodder crops can be grown on arable land, which will maintain milch cows in perfect health and profit throughout the year without the employment of any grass land whatever.

Cows kept on the soiling system without any grazing and with the minimum of exercise, milk well and keep in good condition. The calves produced are healthy and grow well.

It also appears that land under forage crops practically cleans itself of weeds and can be successfully farmed without the rotation system. The soiling system is financially sound,

and can be generally recommended in suitable districts, especially in regions with a high rainfall where cereal growing is risky.

By adopting the soiling system it is possible to increase production over what can be obtained from the established four-course rotation, the latter being most profitable with medium rather than high farming. The soiling system increases production, and at the same time lowers costs per unit of produce. The success of these experiments suggests a new standard in farming, the ultimate possibilities of which cannot be gauged.

Arable land dairying offers a hopeful opportunity for an immediate increase in the output of British agriculture, as well as the profitable employment of capital, the regeneration of the countryside, and the home production of essential human food.

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DURING the War women who volunteered for service on the land to help in the emergency, and wished after the War to farm on their own account, were promised special facilities. In pursuance of this promise the Women's Branch of the Ministry and County Committees in charge of the Land Army considered the establishment of a number of farms to be run by women as a preliminary to successful land settlement. Financial difficulties delayed the scheme for some time, but it was finally decided that the Women's Branch and the Women's Committees might take over the working of certain derelict farms if they were prepared to do so. These farms had been taken from their tenants by the County Executive Committees under the Defence of the Realm Regulations, and were, therefore, some of the worst cultivated in their respective counties. In spite of these difficulties the women undertook the work, and the following farms were taken over :—

**Farms cultivated
by Women.**

- (a) Moor House Farm, Scruton, Yorkshire. (140 acres.)
- (b) Creech Barrow Farm, Somerset. (10 acres, all grass.)
- (c) Grove Farm, Newport, Mon. (150 acres.)
- (d) Great Bidlake, Devon. (134 acres.)*
- (e) Common Farm, Church Hill, Worcestershire. (161 acres.)

Of these only the Somerset and Devon farms were not derelict. The management of each farm was entrusted either to the

* An article on the cultivation of this farm was published in this *Journal*, October, 1918, p. 834.

County Agricultural Executive Committee, the Women's Committee, or a Farm Committee consisting of women and local farmers with (in some cases) a neighbouring farmer as supervisor, and a working forewoman.

Neglected land under divided control was bound to possess disadvantages of the worst kind, and on much that was taken over there could have been no possible question of profit-making. The results are very interesting. On the Yorkshire farm in less than a year the War Agricultural Executive Committee reported to the Ministry that great improvement in the cultivation of the land had been effected, and that it was now in a fit state to be re-let; there was no loss on the working. On the small farm in Somerset, a loan of £250 was repaid with interest and a profit of £15 made in ten months. The land at Newport was in a starved and dirty condition, houses and drainage were in a very unsatisfactory state, and there was a considerable loss on the working, but the Executive Officer reported that the condition of the land had been improved. The Devon farm was held for two years most successfully, and Professor White, who inspected the farm, reported to the Ministry that the condition of the crops and the farm as a whole reflected great credit on the management, and that the farmyard was one of the best he had seen in the summer of his visit. The farm in Worcester, taken over in 1918, is still in hand.

It will be seen from this brief summary of results that the experiment of putting farms under the control of women workers has been very largely successful, and has demonstrated the ability of women who have had no previous training, but are full of the desire to become farmers, to overcome obstacles that must fairly be regarded as rather out of the common.

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A CORRESPONDENT recently wrote to the Ministry to ask why it was considered necessary for the Government to give

financial support to milk recording
societies. Doubtless there are many
people who have considered the question,

and it may be of interest to set out the very simple reasons. The principle of keeping milk records of cows is one that every dairy farmer should follow in his own interest, but the work has not been done systematically or scientifically to any great extent in this country, and it is very unlikely that it would ever have been taken up had not the Government decided to give dairy farmers

advice and encouragement in the interests of national milk production. In order to secure increased milk production it is very desirable to eliminate the bad milker, and the best way to secure this end is to keep a careful record of the yield of every cow in the herd. In this connection it may be stated that the yield of milk of a cow cannot be determined by the size of the animal's udder, as is so commonly believed by farmers. The well-bagged cow is sometimes a poor milker. Inasmuch as the Government wish to encourage increased milk production in the national interest, the expenditure of public money spent for this purpose is justified. Although the Milk Recording Scheme has only been in operation for a few years, there is every reason to believe that the value of it is appreciated in many districts, and that many new societies are likely to be formed at an early date. It may well be that when farmers have proved that financial benefit does accrue from keeping milk records, they will be ready to carry on with less financial assistance than they now receive. Those who have seen a milk recording certificate will doubtless have noticed that it certifies (a) that the records were kept under the supervision of a milk recording society; (b) that they were subject to inspection without notification by an approved recorder; and (c) that they showed that the yield of milk amounted to so many pounds during the year. Every precaution has been taken to secure absolute accuracy for the information given on the certificate, but the Ministry cannot give guarantees, and does not wish to render itself liable for payment of compensation to which the purchaser of a certificated cow might think himself entitled if the cow was not up to the standard expected. The Ministry, therefore, safeguards itself by issuing a statement in the "Register of Dairy Cows" that it accepts no responsibility for any inaccuracy. At the same time, needless to say, there is very little room left for inaccuracies to creep in.

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THE following note has been communicated to the Ministry by Captain J. A. Symon, D.S.O., M.A., B.Sc. :—

A Farm Institute in Somerset. The Somerset County Council have now taken possession on leasehold tenure of the old mansion house and gardens known as Cannington Court, Cannington, some 3 miles from Bridgwater, for the purpose of establishing a Farm Institute. They have also acquired a lease of the adjoining Court Farm of upwards of 178 acres, one-half being arable.

From an historical point of view the present buildings are extremely interesting. Founded about the middle of the 12th century they were used for some centuries, until the dissolution of the monasteries, as a Benedictine Nunnery. Afterwards they passed into the hands of the Roger family, but at the time of Charles II. the estate reverted to the Crown on account of there being no male issue. It then came into possession of the Clifford family, and for nearly a century and a half was used as the family residence of Lord Clifford. In the 19th century the buildings were again used as a nunnery and afterwards as an industrial school for Catholic boys.

On the completion of certain alterations there will be residential accommodation for the staff, and for 20 male and 10 female students, as well as suitable class rooms, laboratories, a large dairy, and a carpenter's and blacksmith's shop.

The courses of instruction are as follows:—The normal course for male students will extend over two winter terms of about 14 weeks each, and will comprise instruction in such subjects as agriculture, agricultural and veterinary science, farm accounts, surveying and horticulture. Part of each day will be devoted to practical work on the farm and in the gardens and workshops. A third or summer term will be provided for such male students as desire to complete a year's training on the farm.

The usual course for female students will extend over one term of 14 weeks. Instruction will be provided in dairying (including cheese- and butter-making), domestic science and poultry-keeping. A senior course will be provided for such students as desire to remain for an additional term.

For county students the fee will be £1 per week, this sum covering payment for board and lodging and instruction. Students from other counties will be admitted, provided there are vacancies, at a fee of £1 10s. per week. A certain number of free places will be open to county students.

The object of the instruction given at the Institute will be primarily to prepare young men and women for the daily routine work on the farm or in the farm household. With this end in view theoretical instruction will be co-ordinated with the practical work of the farm. Thus in book-keeping actual farm figures and accounts will be utilised. The management of the different crops and stock kept on the farm, the carrying out of experiments, the actual handling of labour and the care and management of the gardens and orchards, will all form the foundation of the theoretical instruction pro-



Cannington Court, near Bridgwater, leased by the Somerset County Council
for a Farm Institute.

vided in the class room. In the case of female students instruction will be confined to plain cooking and laundry, to the making of the common varieties of cheese in the county, and the keeping of poultry on either up-to-date farmyard principles or on the colony system. Promising students who intend taking extended courses of instruction at universities or agricultural colleges will be encouraged by scholarships to do so. Continuity will in all cases be aimed at. Thus the Institute will work hand in hand with the rural science schools and the rural evening classes on the one hand, and the university or agricultural colleges on the other.

It is expected that the Institute will be in full working order by the spring of 1921. In the meantime the buildings and gardens are being utilised as a training centre for ex-Service men in horticulture and poultry-keeping.

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INCREASING interest is being taken by farmers and commercial fruit and vegetable growers in science as applied to cultivation.

Plant Hygiene. Both old established societies—content in the past with their practical knowledge of crop cultivation—and newly formed societies—eager to base their operations on scientific lines—are asking for lecturers who can demonstrate to them the advantages of the combination of theory and practice. The Ministry welcome such requests, and are endeavouring to meet them as far as possible.

In the middle of January a lecture was delivered in Norwich by Mr. G. C. Gough, B.Sc., an Inspector of the Ministry, on the subject, "Plant Hygiene in relation to Crops." Mr. Gough first pointed out that *cleanliness* is as important to plants as to human beings, and gave instances of the large losses sustained in this and other countries from the depredations of the pests and diseases of plants and crops.

With regard to *measures of control*, the lecturer considered the subject under the four headings: (1) exclusion, (2) protection, (3) eradication, (4) immunisation. Under the first of these he dealt with the necessity of suitable crop rotation, whereby the succession on the same land of crops subject to the same pest was avoided; the advantages of reasonable separation when planting patches of such crops as bush fruit, in view of the possibility of epidemic outbreaks of disease; and the need for care in the purchase of seed, bushes or fruit-tree stocks to avoid the introduction of disease. Mr. Gough emphasised the large extent

to which nurseries and seed firms are involved in this question, and in pointing out that the grower deserves every assistance to obtain clean and good material, he foreshadowed the probability of legislation to deal with this aspect of the matter.

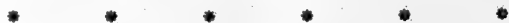
Under the heading of *protection*, the lecturer drew attention to the necessity of proper watering and ventilation for crops under glass, and the advantages of spraying and of soil sterilisation as an insurance against the attacks of insects, fungi, etc.

It is difficult to draw a line between measures of protection and of eradication, and certain measures included by the lecturer under the latter heading apply equally to the former. Under whatever heading they are included, they constitute some of the most important precepts of plant hygiene, and the danger was emphasised (1) of permitting the rubbish heap to become the manure heap, and thus the breeding place of obnoxious plant pests, and (2) of feeding pigs and other animals on diseased food plants that had not been boiled. The lecturer pointed out that the passage of fungus spores, unharmed, through the digestive system of animals, entailed their return to the land under conditions extremely favourable to the vigorous recurrence of disease.

Referring to the question of *pruning*, the lecturer urged its importance from the point of view of the removal of diseased wood, as well as from the purely cultural standpoint, and pointed out that to prune away diseased material without also burning it was but labour in vain. Mr. Gough also spoke at some length on the value of contact and poison insecticides and of the winter washing of fruit trees.

Of all matters relative to plant hygiene, the breeding of varieties immune from disease presents, perhaps, the largest field to the scientific investigator. The lecturer demonstrated by reference to those varieties of potato immune from Wart Disease that absolute immunity is an established fact; he pointed out the desirability of breeding varieties of crops immune from all the diseases to which they are at present liable, and also of combining this general immunity with good cropping and feeding qualities.

While it would be unwise to lose sight of the necessity of careful drainage, cultivation, manuring, etc., in the raising of healthy crops, attention to the measures outlined by Mr. Gough will be of increasing benefit to the grower and to the nation.



THE campaign by the Ministry for the improvement of grass land in this country, outlined in a note in the issue of this

**The Improvement
of Grass Land.**

Journal for last month (p. 1058), was inaugurated on Saturday, 14th February, when Dr. Somerville, Sibthorpian Professor of Rural Economy in the University of Oxford, delivered an address at Leicester to a large gathering of farmers under the chairmanship of Sir Thomas Cope, Bart., Chairman of the Leicestershire County Council and of the County Education Committee.

Professor Somerville stated that in England and Wales there are about 14,000,000 acres of permanent grass land, excluding hill grazings, an area greater than that under arable cultivation. While some of this permanent grass is of excellent quality, and not susceptible of much improvement, there is a considerably larger proportion which is doing but little either for the individual or for the nation. One can meet with poor pastures and meadows in all parts of the country, although they are, perhaps, commonest on heavy land and on the chalk formation.

While a certain amount has been done to improve these poor pastures, it is unfortunately true that many farmers regard them with indifference. Yet most of this land is so easily and profitably improved that farmers who are fortunate enough to own or rent it have ready to their hand an opportunity for such an investment of capital as a man of business would envy. The return which much of such land gives to judicious expenditure is usually far greater than in the case of arable land. Assuming that a man has a field of wheat on which the use of £2 worth of artificial manure sends up the yield from 3 qr. to 4 qr. per acre, he would be well satisfied with the result. It would mean an increase of yield of 33 per cent., and a net profit of about £2 per acre. Now the kind of manure that is used to stimulate the growth of wheat leaves but a scanty residue, so that little remains to help the next crop, but in the case of much poor grass land the most suitable form of treatment would continue its action during several years, and in the aggregate would, in many cases, give a return of several hundreds per cent. Dr. Somerville spoke of many cases where, before treatment, grass land has carried during summer two store sheep per acre, and these during the season have increased about 20 lb. each in live weight, or an aggregate increase of 40 lb. per acre. As the result of treatment the land has carried not two, but four sheep per acre, and instead

of each animal increasing 20 lb. it has gained 40 lb., so that the aggregate gain per acre has been 160 lb.—a four-fold increase. The profits, too, are on much the same scale. Without taking extreme cases, it may be said that it would only be a moderate result if for an expenditure of £1 one got no more than £5 worth of return, spread over, perhaps, as many years.

Professor Somerville has been experimenting on the improvement of grass land for nearly 30 years, and during that period he has farmed many hundreds of acres, most of it under poor grass. He has never failed to find that grass land is at once responsive to improved treatment, and that no class of farming gives such a liberal and certain return on capital expended.

The improvement of grass land is so simple that those who have studied the question are surprised that there is any poor land left to improve. In the great majority of cases all that is required is a liberal dressing with phosphates. Basic slag is to be preferred, not only because it is the cheapest form of phosphate, but also because it is the most effective. Superphosphate acts nearly as well, but is more costly. Other forms of phosphate which may be used, if those already referred to cannot be obtained, are precipitated phosphate and mineral phosphate ground to a very fine powder. It is important that a liberal dressing should be applied in the first instance, at least half a ton per acre of basic slag containing 25–30 per cent. of phosphate of lime. The result is that clover plants, which before treatment were so small as scarcely to be seen, grow with such vigour that in a year or two one would think that there was little else than clover in the pastures. The feeding value of the clover thus stimulated is so high that cases are known of sheep on improved pasture without cake actually putting on more weight than similar animals grazing adjoining unimproved land and daily consuming the greater part of 1 lb. of cake per head.

The improvement, therefore, depends on the presence of clover plants or other *Leguminosæ*. Of all these plants wild white clover is the best, because on account of its creeping habit it rapidly fills up a pasture when it is supplied with phosphates. In the great majority of cases the plants are present and only need stimulating. If they are not naturally present they must be introduced by sowing some seed of the genuine wild variety. The demand for such seed is very keen, and the price has now risen to over 30s. per lb., so that, if it has to be purchased, about 1 lb. per acre must suffice. Farmers, however, can quite easily grow their own supplies. All they have

to do is to stimulate the wild white clover on an acre or two of pasture by a liberal dressing of phosphates, and then cut the crop when dead ripe. It is subsequently threshed and roughly dressed, and with cheap home-grown supplies 5 or 6 lb. of seed per acre may be used. Dr. Somerville has had remarkable success in renovating pastures in this way.

In the great majority of cases phosphates alone are necessary for the treatment of pastures, as contrasted with meadows. In a few isolated cases the addition of 3 to 4 cwt. per acre of kainit, or some other form of potash, may be profitable. Lime used concurrently with the phosphate will generally add something to the yield, but it is seldom that the increase will be profitable. Nitrogen should not be used on a pasture in any form. It will stimulate the grass and weeds at the expense of the clover, with the result that the plant, which above all others should be encouraged, is in danger of being crowded out.

It is surprising how long the effects of phosphates are maintained. In the majority of cases they are plainly visible for ten years, but in about five years from the first application a dressing of about half the original dose should be given, and the response in many cases will be almost as good as to the first treatment.

The clovers, stimulated to luxuriant growth by the phosphates, gather large quantities of nitrogen from the air and store it in their tissues. This nitrogen, secured at no expense, will make its presence felt should such land be put under the plough. Experiments with cereals on land which has been slagged when under grass, and subsequently broken up have shown that the corn grown on such land was 20 per cent. better than crops grown on broken-up turf that had not been slagged. If, therefore, it is decided to plough up grass land, it should be put through a course of phosphatic manuring while still in grass. The improvement of grass and the policy of the plough are not incompatible.

* * * * *

IN connection with the Ministry's scheme for the improvement of grass land, referred to in the above note, the Ministry have recently issued two pamphlets for the information and guidance of those interested in the subject.

**Publications on the
Improvement of
Grass Land.**

The first publication (Miscellaneous Publication No. 24) deals with the general question of grass land improvement. It is a pamphlet of 50 pages, and is

written in a simple and not too technical style, so as to be easily understood by the average reader. The various types of grass land, permanent grass, worn-out grass, and temporary leys, are dealt with, and the possibilities of improvement considered under such headings as manuring, mechanical treatment, renovating mixtures, altered methods of stocking, substituting pasture for meadow conditions or the reverse, and eradication of weeds. Notes on the grasses and clovers used in pasture, the purchase of seeds, and the types of seed mixtures, are also given, as well as information on the conversion of heavy clay land to grass, lucerne and sainfoin leys, and on the treatment of new pastures. Suggestions for increasing the produce of grass land, based largely on experiments made in different parts of the country and on the investigations of Professor Stapledon of the University College of Wales, Aberystwyth, are offered throughout the pamphlet, although to obtain the best results the farmer must understand the different requirements of grass land according to soil, climate, stocking, utilisation, etc.

The second pamphlet (Miscellaneous Publication No. 25) is entitled "The Improvement of Grass Land: Suggestions for Demonstrations and Experiments," and its title explains the purpose it is intended to serve. It may be regarded as supplementary to Miscellaneous Publication No. 24, and the suggestions it contains should be considered in the light of the information given in that publication. It was felt in planning the grass land improvement scheme that an important factor in its success would be the establishment in various parts of the country of suitable demonstration plots. With this view, the scheme of demonstrations and experiments outlined in the pamphlet has been drawn up for the consideration of all interested in the subject. While in no sense exhaustive, the scheme is believed to cover many questions of pressing practical importance. The trials are essentially demonstrations of facts that have been proved generally, rather than experiments for the purpose of acquiring new knowledge or of testing disputed opinions. The pamphlet is divided into two parts. Part I. comprises schemes simple in character and direct and practical in their object, so that they may be capable of general adoption by farmers. Part II. deals with experiments requiring considerable attention and supervision, which are applicable chiefly to college farms or farms in close touch with the Educational Staff of the county.

All farmers who are interested in the subject of grass land improvement are advised to study these pamphlets. They

may be obtained from the Office of the Ministry (Publications Branch), 3, St. James's Square, London, S.W. 1. The price of Miscellaneous Publication No. 24 is 3*d.*, post free, and Miscellaneous Publication No. 25 may be obtained gratis and post free.

* * * * *

ALTHOUGH the condition of our orchard and fruit plantations to-day shows a marked improvement over that of a few years ago, it still leaves much to be desired. If **Weak and Diseased Fruit Tree Stocks.** fruit growers generally are to be congratulated upon the manner in which they have made use of the results of scientific and technical investigation carried out in their interests, there are too many who are content to remain behind the times, and who do not realise the importance of care and foresight in the business of fruit growing. For example, in buying fruit trees to start a new plantation it can only be false economy to purchase inferior stocks. A plantation is put down to bear fruit for many years, and compared with the value of the crop, year by year, the difference in the initial cost of good and bad stocks becomes quite a trifling matter. Yet one frequently hears of fruit growers taking considerable trouble to obtain cheap supplies.

While this state of affairs exists it is not surprising that nurserymen continue to find buyers for the inferior stock which would normally be relegated to the rubbish heap. Examination of recently-established plantations sometimes reveals apple trees affected with canker, brown rot, crown gall and American blight, plum trees affected with silver leaf, black currants with big bud, peaches with leaf curl, and so on. Even where trees are not affected with disease they are often constitutionally weak and of poor or stunted growth, and, occasionally, altogether devoid of a proper root system.

Under these conditions, it is not surprising that obnoxious fruit pests abound throughout the country, and that large quantities of inferior fruit are on the market.

At the present time conditions are not normal. Stocks are low and there is also a shortage of labour. There is some reason for confidence that both quantity and quality will improve before long in many nurseries at present below their pre-war standard, but the need for these improvements must be pressed vigorously and continuously. It is encouraging to see that the more progressive growers are awakening to the necessity of procuring only the best stocks. Having obtained

them, they are doing their best, by a reasonable and regular system of winter washing, grease banding, spraying, pruning and rubbish destruction, to keep their orchards clean and free from pests. What is needed in the interests of fruit growing is that the methods and practice of the best and most far-sighted growers should be better known and more generally imitated.

* * * * *

CERTAIN statements recently published in the Press disclose considerable misunderstanding with regard to the object and

**The Ministry and
the River Ouse
Drainage Scheme.**

effect of an Order made recently by the Ministry for the purpose of establishing a single drainage authority to control the whole of the main channels and banks of the River Ouse and its tributaries.

It has been alleged that if the Order becomes effective the Ouse Drainage Board will embark forthwith on a scheme for putting the river into order at a cost of not less than £3,000,000. Such a statement is, of course, entirely misleading and incorrect. In the first place, the highest estimate yet put forward as the possible total cost of putting the whole river into proper order (and this was a figure put forward by the opponents of the Order at the public inquiry) was not £3,000,000 but £2,000,000.* In the second place, even assuming that such a figure represented the probable cost of putting the rivers into order, it is obvious that the work would necessarily be extended over a great number of years, and that at nothing approaching such a sum would ever be raised at once. The Ouse Drainage Board, when established, will be a body elected by the ratepayers of the district, and it is inconceivable that a body of that nature would embark upon any such fantastic career of extravagance as is suggested by the persons who have made the statements referred to above.

Calculations have also been put forward, and results have been published in letters to the Press, of the amount of the rate per acre which may be expected to be imposed on agricultural land in the upper valley of the Ouse by the Ouse Drainage Board. Those calculations were not only made on false assumption that the Drainage Board will raise a sum of £3,000,000 by a single loan, but they appear to have been based on the original draft of the Ouse Drainage Order. The rating schedule contained in that draft was revised drastically in favour of the upper parts of the valley before the Order was sealed by the

* The Ministry has recently been informed that the figure £3,000,000, which appeared in a letter to *The Times*, was a mistake, and that the writer of the letter intended to write £2,000,000.



FIG. 1.—Before cleaning, 1918.



FIG. 1a.—After cleaning, 1919.



FIG. 2.—Before cleaning, 1918.



FIG. 2a.—After cleaning, 1919.

Ministry of Agriculture, and hence any calculations made upon the basis of the original draft are of no value.

The Order has further been criticised on the ground that it does not include in the rateable area of the Ouse Drainage Board any lands situated at a greater height than 8 ft. above the highest recorded flood level. It is considered by many that the whole of the lands from which water finds its way into a river should, in justice, be rated for the maintenance of that river. This view has been urged repeatedly before both Houses of Parliament, and the subject has been fully considered by a Committee of the House of Lords. The result, however, is that the general law relating to land drainage remains as it has always been since the year 1531, and the fundamental principle of that law is that no land can be rated for the maintenance of a river unless it derives some degree of benefit from such maintenance. The best modern agricultural opinion is that such benefit cannot be said to extend to land lying at any greater height than (approximately) 8 ft. above flood level, and for that reason no land outside the "8-ft. line" is included within the boundaries of new Drainage Districts.

Generally, it is important that all who are interested in the question of the drainage of the Ouse valley should bear in mind that the new Drainage Board will be entirely free to shape its own policy. At the same time it will be subject to the restrictions which are imposed by the general law and by the Ouse Drainage Order itself, as to expenditure on new works and the improvement of existing works. Finally, it will be an elective body, and will, as such, carry out the wishes of the ratepayers by whom it will be appointed.

* * * * *

THE four photographs reproduced, taken in 1918-19, show two sections of the work carried out by the Anglesey Agricultural

Land Drainage in Anglesey.

Executive Committee under the powers of the Defence of the Realm Regulations for the drainage of Malldraeth Marsh.

Before the work was taken in hand by the Committee, practically all the drains in the Marsh were in the condition shown in the two earlier photographs. The total length of drains and ditches cleaned out by the Committee in the way illustrated cannot be given exactly, but it is estimated that at least 4,000 acres of land in the Marsh have received substantial benefit. The total cost of the work amounted to approximately £2,400.

This is only one of a large number of similar undertakings which have been carried out by Executive Committees in low-lying lands throughout England and Wales during the past two years.

* * * * *

THE Report on the Lincoln Tractor Trials was issued by the Society of Motor Manufacturers and Traders a few weeks ago,

**The Lincoln
Tractor Trials.**

but it does not seem necessary to add very much to the preliminary notice which appeared in this *Journal* in October last, while the data afforded do not suggest any modification of the conclusions then expressed. A summary of the results printed in the Technical Advisor's Report has already appeared widely in the agricultural press, and no object could be served by reproducing them. The most serious omission is any statement of the actual work accomplished by the tractors: the figure for the "estimated acres per day of eight hours" is of very little value, and without the data upon which it is based may be positively misleading. Although it might be suggested that it would be a little unfair to take the number of acres ploughed and the time taken by stoppages during a trial of a few days' duration as the basis for a calculation of the amount of work to be expected during the whole life of the machine, yet there is no escape from this method if all the other figures are based, as they are based, upon the recorded performances during the trial. It may be assumed, although it is not directly stated, that the estimated acreage per eight hours is deduced from the actual performance plus an allowance for time recorded as lost either on the tractor or the plough. If this be so, the actual performance may be calculated with a little trouble.

The Technical Advisor's Report takes up the major portion of the volume and rather overshadows the Judge's Report. The standpoint from which the Judges regarded the trial is sometimes a little obscure. As regards the first tractor on the list, they express the opinion that "the weight of this tractor, 3 tons, is excessive for work on the land, especially on heavy land in wet weather," and this note runs through a number of their criticisms. In their general remarks, for instance, they state that "the use of caterpillar tracks undoubtedly reduces the pressure per square inch on the land, and where well designed may permit of ploughing under conditions where a wheeled tractor could not be used." It may be asked, however, whether there is any advantage in seeking

to plough under "unfavourable" or "adverse" weather conditions, as the Judges express it in various places. In the past the farmer has had frequently to work when he would, if he could have chosen, have deferred doing so until soil conditions were suitable, and it may be suggested that the one great contribution that the tractor will make to farming will be to enable the farmer to take advantage of the "favourable" weather. The proposal that has already been made that implements should be adapted or remodelled to meet the increased speed which may be expected from tractors in the future has much bearing upon this point.

In their comments upon the ploughs used, the Judges several times refer to ploughs being driven too fast. Does not this really mean that the plough will turn a suitable furrow at a certain speed, but that above this speed some defect discloses itself? This is exactly the information that is required, and the hope may be expressed that any future report will contain a statement of the critical speed and the precise defects which develop beyond this point, and, if possible, the reasons. With such knowledge progress in the design of tractor ploughs—and, indeed, of all other tractor implements—would be accelerated.

In conclusion, it is proper to say that the Report is admirably produced, and that whatever deficiencies there may be, these are not numerous for a new venture. Upon the basis of the first Report it will be a comparatively easy task to produce, after future trials, Reports giving complete data relating to both tractors and implements, having regard throughout to the limited period covered by trials of this nature.

* * * * *

AN arrangement has been reached whereby the Society of Motor Manufacturers and Traders, Ltd., will join the Royal

**Tractor Trials
in 1920.**

Agricultural Society in carrying out tractor trials in the autumn of the present year.

At first it was feared that there would be two separate trials, which would have entailed inevitably much waste of time, money and work. The value of the trials to those who are using or propose to use tractors will undoubtedly be enhanced by the union of two such powerful bodies as the R.A.S.E. and the S.M.M. & T. One of the chief benefits of this united exhibition will be that the farmer will have an opportunity of seeing every machine at work and making comparisons on the spot between the various performances. It was found when the two Societies met to discuss united

trials that there was only one question outstanding between them and that was the question of making the trials competitive. The one united show is certainly likely to be more representative than either of the two proposed independent trials could have been. The result of the deliberations of the Joint Committee now appointed by the two bodies will be awaited with interest. The report of the Lincoln Trials shows clearly that a very substantial advantage rests with the principle adopted by the S.M.M. & T. of stating the actual performance of each machine, although, even there, the competitive element cannot be said to have been entirely eliminated.

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In choosing seed for silage crops or summer fodder preference is usually given to tares or other legumes, because they produce

**The Best Seeds
for Silage and
Summer Soiling.**

a forage containing a high proportion of albuminoids. In the case of tares or peas the stems are so weak that they cannot support their own weight, and some other plant becomes necessary to provide the support required; if this is not given the crop lies on the ground, is liable to rot at the base, and becomes very difficult to cut. The inclusion of a small proportion of beans will help to mitigate this defect. The addition of oats to the mixture is also an advantage, as the oats serve not only to support the weaker legumes but also to provide a suitably-balanced fodder.

Both tares and peas are relatively scarce at the present time, tares being the more expensive. Peas, therefore, may be used to replace tares in whole or in part.

A suitable mixture for spring sowing would be :—

2 bush. oats	} per acre.
1 „ field peas or vetches	
$\frac{1}{2}$ „ beans	

Forage mixtures such as the above may be used with advantage for silage, for soiling, or for making into hay; they may also partly replace roots on the heaviest classes of soils. (If intended for hay, beans should be omitted.)

A moderate dressing of farmyard manure, where available, will give good results in most circumstances; so also will the following mixture of artificials :—

$\frac{1}{2}$ cwt. sulphate of ammonia	} per acre.
2 „ superphosphate	
$\frac{1}{2}$ „ sulphate of potash	

* * * * *

ATTENTION is called by the Michigan Agricultural College in their latest quarterly Bulletin for November, 1919, value to the of forage crops for pigs. Experiments in that State have proved that from one-quarter to one-half less grain is required to produce a given amount of pork on forage crops than is needed under conditions where these are not available.

**Forage Crops for
Pigs: The Value of
Rape.**

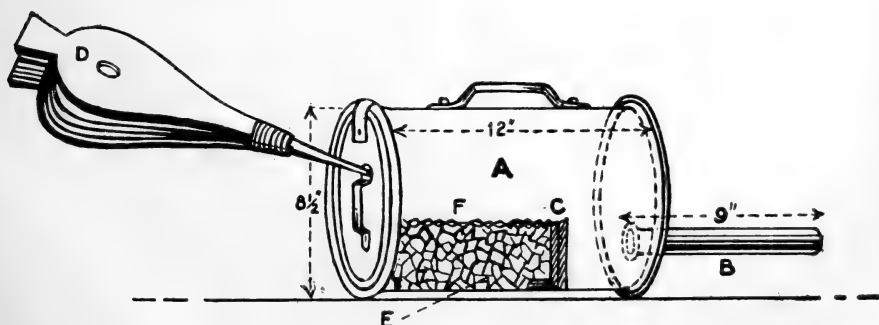
The crops recommended are a mixture of oats and peas, and also rape. Rape seems the best crop for the purpose in Michigan, and pigs make rapid growth on it when it is supplemented by a medium grain ration. It is usually sown broadcast for the purpose at the rate of 5 lb. per acre (Dwarf Essex being the variety recommended) between early spring and June; on light, sandy soils it may be advisable to sow in drills, using 3 to 3½ lb. seed per acre.

Pigs would then be turned on the rape when it is about 8-10 in. high; this is usually about six weeks after sowing. With frequent rain, and if the rape is kept fairly well down, new shoots will develop. A plan recommended is to sow at least two plots and change the pigs over from one to the other, thereby giving the new shoots a chance to develop.

* * * * *

RAT poisons such as squills and barium carbonate can be used with good effect and without risk to other animals or live stock, if applied with all due care, but many poultry farmers, pig keepers and stock owners are reluctant to use any form of poison to destroy rats under poultry runs, pig-styes, etc.

**A
Simple Apparatus
for "Gassing" Rats.**



The simple apparatus here illustrated can often be used to fumigate the rat runs in banks and hedgerows, and under

fowl houses and styers, and has the additional advantage of cheapness, being easily made from old material. In order to make the apparatus the procedure is as follows: Take an old paint drum (A) of about 12 in. in length and $8\frac{1}{2}$ in. in diameter, fasten the lid to the side with a link hinge, and punch a hole in the lid to admit the point of a pair of small bellows (d). In the base of the drum punch a hole 2 in. in diameter and in this hole fix a piece of metal piping (B) 9 in. in length. A strip of metal $2\frac{1}{2}$ in. high should be rivetted on the inside of the drum at (c) to prevent the cotton waste (e) and small sulphur (f) choking the orifice of B. To facilitate carrying a small handle can be fixed to the side of the drum as shown.

When the apparatus is to be used the lid should be opened and some old oily cotton waste placed within and ignited. If necessary, the lid should be closed and the cotton waste fanned with the bellows to a good glow (if the lid is left wholly or partly open, free contact with the air will often be sufficient to cause the cotton waste to glow). With a view to finding out connecting runs in a burrow, in banks and hedgerows, as soon as smoke issues from spout B of the apparatus the spout should be placed in a hole, if possible to the windward of other holes. All holes from which smoke issues, except one of the lower ones and the highest, should then be plugged lightly. The drum should then be opened and a layer of sulphur (f) be sprinkled on the glowing cotton waste. The spout (B) should then be inserted into the lower hole and the bellows (d) be used. In a few minutes colourless sulphur dioxide will be generated, and in about a quarter of an hour or longer, according to the size of the burrow, the rats will either succumb to the gas or try to bolt—in the latter case to be easily dispatched by sticks and dogs. This gassing has the advantage of killing both large and small rats at a minimum cost, and the fumigated burrows, if not immediately destroyed, will not be used again for some time.

* * * * *

Organised Measures for Rat Destruction.—As a consequence of the Rats and Mice (Destruction) Act, 1919, which came into force on the 1st January, the Ministry of Food have revoked as from the 7th March the Rats Order, 1918-19. Local Authorities have no longer, therefore, the power to pay rewards out of public funds for the killing of rats. What was previously encouraged by way of reward is now imposed

**Organised
Rat Destruction.**



"Bag of Rats" (275) obtained in three days during threshing at a farm in Herefordshire. In this county Rat Destruction is being carried out on original self-supporting lines, under the supervision of a Rat Officer.

upon the owner or occupier of premises as a legal obligation. Great commercial companies are recognising their duty. The London and North-Western Railway Company, for example, have appointed an Officer to supervise rat destruction over their whole system, and a committee consisting of members of the various branches of the service has been formed to co-operate with him. The Ministry have addressed a letter to all Railway Companies informing them of the action of the London and North-Western Railway Company and suggesting that they should follow this example. The County and Urban Authorities have also been very active. Since the passing of the Act many counties and boroughs have appointed officers to administer the Act. In Leeds a Rats Officer has been appointed to conduct a special campaign. The Swansea Port Sanitary Authorities have appointed their Chief Inspector as an Executive Rat Officer, and in several counties authorities are beginning to receive the thanks of farmers, who now realise that the steps taken to destroy vermin are likely to have most satisfactory results. The work done in England is attracting considerable attention in the Overseas Dominions and elsewhere.

The Third National Rat Week.—The Third and last National Rat Week of the season was carried out between 23rd February and 1st March. The evidence which has been collected as a result of these national measures for rat destruction shows quite clearly that the Rat Weeks have served to reduce the enemy by many millions, and that the saving to the country must amount to very many times the expense involved. Very much, of course, yet remains to be done. On one farm in Herefordshire a short while ago 275 rats were killed during threshing operations, while in Monmouthshire, during the threshing of four wheat stacks on a farm, the Rats Officer and his assistant destroyed upwards of 1,000 rats.

A significant result of the National Weeks can be gathered from letters received by Local Authorities, which show that in districts round large manufacturing centres that have been properly treated there has been a great diminution in the number of rats seen.

Establishment of Research Laboratory.—The Treasury have sanctioned the establishment of a research laboratory, in which research work and investigation with a view to improving in methods of rat destruction will be carried out.

It is believed that a number of the many pig insurance clubs in the country are not being run at present on sound financial lines. Recent investigation has shown

Pig Insurance. that some of them have good balances in hand, but these balances are apt to mislead. If any of the clubs were to suffer losses they would probably be crippled very quickly owing to the large amounts they would have to pay out to their members. The present price of pigs is high, and compensation would need to be very large in order to be effective. The only way of meeting the difficulty is to make the subscriptions of members bear a proper relation to the risks, and those responsible for the direction of the pig clubs would be well advised to assure themselves that this is the case in their own club.

When insurance clubs were first started, members were asked to pay sums varying from 6*d.* to 1*s.* a quarter for each pig insured. Anyone who will consider the position that would arise in a club of 40 to 50 members if heavy and unexpected losses took place will see that subscriptions of 4*s.* a year or less per pig must needs prove quite inadequate to the requirements of the case. It is, therefore, suggested that pig insurance clubs should raise their subscriptions without delay in order to meet the altered conditions. The Small Livestock Branch of the Ministry has dealt with this question for several societies, and is prepared to give advice and assistance to any that may desire to avail themselves of it.

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A CONFERENCE of bee-keepers was held in February at the Surveyors' Institute, Westminster, London, S.W., 1, to discuss

**The Government
and the Bee-Keepers.**

the question of legislation to check Isle of Wight and other bee diseases. Bee-keeping Associations and Agricultural Education Committees were represented, and invitations were also sent to a number of experienced bee-keepers, particularly to those who were known to be in opposition to the proposals for legislative action. There was considerable preliminary discussion, which showed that differences of opinion among experts in bee-keeping existed, but a resolution urging the introduction of legislation was passed almost unanimously. Details of the Bill it is hoped to put before Parliament during the present session were discussed, and finally the meeting decided unanimously in favour of the compulsory registration of all bee-keepers. The discussion revealed the fact that while

there are not nearly enough hives in the country the number of careless bee-keepers is far too many, and that these people are largely responsible for the spread of disease. That there is great room for improvement in the existing conditions is best shown by a statement made at the Conference that of every 4 lb. of honey eaten in this country 3 lb. are imported.

* * * * *

THE attention of farmers, small holders and others is called to the extensively advertised sales of surplus Government

Nissen Huts. Stocks of Nissen huts. The dimensions are: length, 27 ft 6 in.; width, 16 ft.; height, 8 ft. The huts consist of semi-circular sections in black corrugated iron, steel and wood, complete with all necessary fittings and ready for immediate erection.

Each hut forms a permanent building, absolutely weather-proof and of great durability, suitable for housing, storage or workshop, or for accommodation for calves, or shelter for pigs or sheep.

Prices range from £25 each for single huts, or £20 each for a quantity at Government depots at Slough and Woolwich, and inquiries should be addressed to the Controller, Government Surplus Property Disposal Board, Artillery Mansions, Victoria Street, London, S.W. 1.

THERE has been an appreciable fall in prices of feeding stuffs, especially cakes, since last month, due no doubt to the fact that there are more than average stocks

**Notes on Feeding
Stuffs for April:**

*From the
Animal Nutrition
Institute, Cambridge
University.*

in the country. Refined oils have increased in price, and this may have enabled the cake crushers to take less for their cake. The fall in price has not been uniform, however, as is shown by the following table, which gives prices per ton and per food unit of a number of common feeding stuffs. The prices are approximately those realised at London wharf or store. Local prices will in most cases be rather higher on account of freight and commission.

TABLE I.

	No. of Food Units per Ton.	Price per Ton.	Price per Food Unit.
		£ s.	s. d.
Palm kernel cake	96	12 0	2 6
Wheat middlings—coarse	90	12 10	2 9
Ground nut cake—semi-decorticated ..	110	16 10	3 0
Coconut cake (home-made)	103	16 0	3 1
Wheat bran	78	12 10	3 3
Decorticated cotton seed meal	126	22 10	3 7
„ „ cake, American	126	23 0	3 8
Brewer's grains, dried	85	16 5	3 10
Soya bean cake	122	24 0	4 0
Linseed cake, Indian	123	24 15	4 0
„ „ English	123	24 10	4 0
Chinese beans	101	20 10	4 1
Cotton cake, English made	72	16 0	4 5
„ „ Egyptian	72	16 5	4 6
„ „ Bombay	65	15 0	4 7
English beans	100	23 15	4 9
Maize meal	86	20 10	4 9
„ American	94	23 0	4 11
English oats	75	21 10	5 9

The table shows the very great variations in the value of different feeding stuffs at present prices. Thus, English Oats cost considerably more than twice as much per food unit as palm kernel cake or wheat middlings. Reference to Table II., giving the composition of common feeding stuffs, shows that among the first five feeding stuffs in Table I., all of which under present conditions must be considered cheap, there is very great variety in composition.

Palm kernel cake contains 14 per cent. of digestible protein and 6 per cent. of digestible oil. It is not so rich in these

TABLE II.
FEEDING VALUE OF COMMON FEEDING STUFFS.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Name of Feeding Stuff.	Nutritive Ratio.	Per cent. digestible.			Digestible Food Units per ton.	Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
		Protein.	Fat.	Carbo-hydrates and Fibre.			
Foods Rich in both Protein and Oil or Fat.							
Ground nut cake ..	I: 0.8	45.2	6.3	21.1	145	78	102
Soya bean cake ..	I: 1.1	34.0	6.5	21.0	122	67	88
Decort. cotton cake ..	I: 1.2	34.0	8.5	20.0	126	71	93
Linseed cake, Indian ..	I: 1.9	27.8	9.3	30.1	123	77	101
Linseed cake, English ..	I: 2.0	26.7	9.3	30.1	120	76	100
Cotton cake, Egyptian ..	I: 2.1	15.5	5.3	20.0	72	40	53
Cotton cake, Bombay ..	I: 2.5	13.1	4.4	21.5	65	38	49
Distillers' grains ..	I: 2.9	18.7	10.2	29.0	101	57	75
Maize gluten feed ..	I: 3.0	20.4	8.8	48.4	122	87	115
Brewers' grains, dried ..	I: 3.5	14.1	6.6	32.7	85	50	66
Coconut cake ..	I: 3.8	16.3	8.2	41.4	103	77	101
Palm kernel cake ..	I: 4.5	14.1	6.1	48.9	96	77	101
Linseed ..	I: 5.9	18.1	34.7	20.1	154	119	157
Bombay cotton seed ..	I: 6.6	11.0	16.8	30.1	100	78	102
Fairly Rich in Protein, Rich in Oil.							
Maize germ meal ..	I: 8.5	9.0	6.2	61.2	99	81	107
Rice meal ..	I: 9.4	6.8	10.2	33.2	79	68	90
Rich in Protein, Poor in Oil.							
Fish meal ..	I: 0.1	54.0	2.0	—	125	56	74
Peas, Calcutta white ..	I: 2.1	23.3	1.1	45.9	97	70	88
Beans, English ..	I: 2.6	19.3	1.2	48.2	100	67	88
Beans, Chinese ..	I: 2.6	19.6	1.7	47.9	101	67	88
Peas, English maple ..	I: 3.1	17.0	1.0	50.0	97	70	92
Palm-nut meal (ex- tracted) ..	I: 3.4	15.6	1.9	48.7	92	66	87
Brewers' grains, wet ..	I: 3.5	3.5	1.5	8.6	21	13	17
Malt culms ..	I: 3.6	11.4	1.1	38.6	70	39	51
Cereals, Rich in Starch, not Rich in Protein or Oil.							
Barley, feeding ..	I: 8.0	8.0	2.1	57.8	83	68	89
Oats, English ..	I: 8.0	7.2	4.0	47.4	75	60	79
Oats, Argentine ..	I: 8.0	7.2	4.0	47.4	75	60	79
Maize, American ..	I: 11.5	6.7	4.5	65.8	94	81	107
Maize, Argentine ..	I: 11.3	6.8	4.5	65.8	94	84	110
Maize meal ..	I: 11.0	5.5	3.5	63.9	86	79	102
Wheat middlings ..	I: 4.8	12.8	4.1	52.5	95	73	96
Wheat sharps ..	I: 5.1	11.6	3.4	51.6	90	62	80
Wheat pollards ..	I: 4.5	13.6	3.7	52.5	97	62	82
Wheat bran ..	I: 4.7	11.3	3.0	45.0	78	50	65
Wheat bran, broad ..	I: 4.7	11.3	3.0	45.4	80	48	63
Locust bean meal ..	I: 22.1	4.0	0.7	69.2	80	71	94

valuable constituents as some other cakes: nevertheless, it is a very useful feeding stuff, and is especially suitable as part of the ration of milch cows. It has also been used with success for fattening cattle and sheep, and in experiments on the Cambridge University Farm has given excellent results with pigs. At its present low price it should be widely used for all kinds of stock. Its only drawback is that stock do not take to it at first very readily.

Wheat middlings, the second cheapest food on the list, is almost too well known to need comment. It is far the cheapest feeding stuff rich in carbohydrates at the present time. It is a noteworthy fact that foods rich in carbohydrates have been scarce and dear ever since the early stages of the War, no doubt because of the short supply of wheat which in 1917 and 1918 caused other cereals to be used for milling, and still influence the cereal market generally. Middlings will, no doubt, be largely used for pig feeding, but at its present price it would be found a most useful and economical addition to the diet of fattening cattle to replace roots, which are likely to be running short by now in many districts. In the later stages of fattening, cattle require plenty of carbohydrate in their diet. Normally, this is provided by the sugar in the roots. If roots are scarce it is better to replace them by middlings than by cake. For this purpose 1 lb. of middlings would take the place of 10 lb. of roots, or, say, 4 lb. would replace about a bushel.

At present prices it would also be economical to replace part of the oat ration of farm horses by middlings or bran. For this purpose 1 lb. of oats should be replaced by rather less than 1 lb. of middlings or by $1\frac{1}{4}$ lb. of bran. Replacement should take place in proportion to the starch equivalent.

The third cheapest food in Table I. is semi-decorticated ground nut cake. Since this feeding stuff was noticed on the market last month samples have been obtained and analysed, with the following results, which are shown side by side with the analyses of decorticated and undecorticated ground nut cakes.

				<i>Semi-</i>	<i>Un-</i>
				<i>decorticated.</i>	<i>decorticated.</i>
				<i>Per cent.</i>	<i>Per cent.</i>
Water .. ..	..	..	10.3	9.8	10.3
Protein .. ..	..	..	46.8	34.2	30.2
Oil .. ..	..	..	7.5	9.3	9.1
Carbohydrate ..	..	..	23.2	21.6	21.8
Fibre .. ..	..	..	6.4	17.4	22.9
Ash .. ..	..	..	5.8	7.7	5.7
				100.0	100.0

Semi-decorticated ground nut cake is shown to be intermediate in composition between decorticated and undecorticated cake, but approximates much more nearly to the latter than to the former. The process of decortication consists in removing the husk from the seed before crushing. From the high percentage of fibre in the cake described as semi-decorticated it is evident that the decortication process has not

proceeded very far. Indeed it seems hardly justifiable to use the name even when qualified by the prefix "semi." It has not been possible to make a determination of the digestibility, but it is no doubt very near to that of the undecorticated cake. On this assumption the number of food units per ton is probably about 110. The writer has used a sample of this semi-decorticated cake as an addition to roots and straw for fattening cattle since November last with good results. The cattle have thrived and made good increases. It is a cake with a high percentage of protein, and should not be given in large quantities or the protein in the ration will be unnecessarily high.

Coconut cake is the fourth cheapest feeding stuff on the list, its price per ton corresponding to 3s. 1d. per food unit. Its composition is similar to that of palm kernel cake, and it can be used generally in the same way as that cake.

Wheat bran, the fifth food in order of price per food unit, is so well known and so widely used that no comment on it is required.

A correspondent has kindly suggested that some account should be given in this month's notes of sesame cake. He adds that he bought a quantity of this cake some time ago and found it satisfactory for cattle and sheep. Its keeping qualities were good. A quantity kept for a year did not show rancidity. Sesame cake is obtained by expressing the oil from species of *sesamum* grown in India and Asia Minor. As made in England its composition is:—

						<i>Composition.</i>	<i>Digestible</i>
						<i>Per cent.</i>	<i>Nutrients.</i>
							<i>Per cent.</i>
Water	..	..	..	..	..	9.3	—
Protein	..	..	..	..	..	44.5	40.0
Oil	..	..	..	..	..	11.9	10.7
Carbohydrates	..	..	..	..	..	20.9	11.7
Fibre	..	..	..	..	..	4.5	1.4
Ash	..	..	..	..	..	8.9	—

On the basis of the above figures it contains 130 food units per ton, and its starch equivalent is 73. It has been used largely in France and in Germany. Most of the information about it comes from the latter country, where it is looked upon as a most suitable feeding stuff for dairy cows so long as the daily allowance per cow does not exceed about 3 lb. It is exceedingly rich in protein, and contains much oil. In this it resembles decorticated cotton cake and ground nut cake.

Lime on Land to be sown for Clover.—A common cause of the failure of clover is lack of lime in the soil. Clover will not tolerate acidity, and any deficiency of

Notes on Manures for April: lime soon leads to this undesirable condition. Cases have repeatedly been brought

From the Rothamsted Experimental Station. to the notice of the Rothamsted Experimental Station of the failure of clover seeds, which, after careful examination, was traced to the absence of lime in the soil.

In view of the cost of clover seeds, and the desirability of securing good plants, farmers will be well advised, in cases where there is the least doubt, to have their soils examined in regard to the lime content, so that they can give a dressing if necessary. While it is probably too late to use burnt lime, there is still time to apply ground limestone or ground chalk, both of which are effective in neutralising soil acidity and improving the condition of the clover crop.

Damage to clover as the result of applying sulphate of ammonia to the covering corn crop has also been reported. In our experience this happens only when there is a shortage of lime in the soil, and is a further reason for ensuring adequate supplies. It is quite unnecessary to refrain from the use of spring dressings because of the possibility of injuring the clover.

Purchase of Waste Lime.—A correspondent sent a sample of waste lime material which on drying contained 99 per cent. of calcium carbonate and 1 per cent. of impurities, chiefly magnesium carbonate. The sample was not in good condition or it would have been worth as much as good ground limestone. After drying, however, it could be broken up sufficiently finely to be applied to the land.

No general rule can be given as to the proper quantity of these waste materials to apply per acre. Everything turns on the degree of fineness; some of the waste limes are so lumpy, even after rough drying, that they could not be used at a lower rate than 10 to 15 tons per acre.

The application would have to be made in winter in the hope that the frost would cause disintegration and facilitate distribution. With better drying and some degree of grinding the effectiveness of the material might be increased two or three times, and application could then be made later owing to the greater ease of distributing the material in the soil. Commercial firms turning out waste lime would do well to ascertain whether they could dry and grind the material so as to give the farmer

an effective fertiliser which could be easily applied instead of the less valuable waste product.

Comparison between home-mixed and purchased Compound Fertiliser.—In the Notes for December (this *Journal*, November, 1919) reference was made to a compound fertiliser offered at £19 per ton, and a home-made mixture was suggested which would give the same amount of fertilising constituents at a considerably lower price. This has led to correspondence with some of the fertiliser manufacturers, who felt that the composition stated did not fairly meet the case, and one of the manufacturers made the entirely valid point that the mixture proposed in these Notes was based on the salesman's ammonia figures, whereas in a court of law the salesman would probably have been held to his nitrogen figure which was somewhat higher. Working on this basis it would be necessary to add sufficient sulphate of ammonia to increase the nitrogen by 0.7 per cent., which would increase the cost of the home-made mixture by 15s. per ton. Even after allowing for this increase in value, however, the figure of £19 per ton remains unjustifiable on a purely cost basis. We have every desire to be fair to the fertiliser manufacturers, and the sole purpose of the note was to draw attention to the price, which is admittedly in excess of what a first-class manufacturer would charge.

Growth of Swedes where the Supply of Farmyard Manure is limited.—A Lancashire correspondent asks what fertiliser he could use for swedes in the following conditions :—(1) He has not much farmyard manure ; and (2) Swedes do so well on one field that he is anxious to grow them there again if he can.

Numerous experiments on the manuring of swedes which have been carried out by Professors Somerville and Gilchrist and others in the north of England have shown that it is unnecessary, as a rule, to use both farmyard manure and artificials for swede crops.

It is well known that good results can be obtained with farmyard manure, but where insufficient is available to allow of suitable dressings, good results can be obtained with 4 to 6 cwt. of superphosphate or basic slag, together with 1 cwt. sulphate of ammonia, at the time of sowing, then 1 cwt. nitrate of soda as a top dressing at the time of singling.

With reference to the question as to whether swedes can be sown on the same land year after year, the chief trouble is in regard to the flea beetle ; provided this pest is absent there is no particular difficulty in growing successive crops of swedes.

At one time 15 successive crops were raised on the Barnfield at Rothamsted, and so long as manure was applied the crops did well.

Effect of Ammonia on Wireworms.—Certain observations at the Rothamsted Experimental Station have shown that ammonia (not sulphate of ammonia, but the base itself) is distinctly harmful to wireworms. This substance is produced in soils where liquid manure is applied and where sheep are folded on the land. A correspondent sends us a letter from a manure merchant quoting these facts, and stating that his organic manure is also a cure for wireworms, presumably through the liberation of ammonia. It should be pointed out that there is no evidence that ammonia is liberated from organic manures in sufficient quantity at any one time to injure wireworms, and in no case is the material as unstable as urea, which is present in the excretions of sheep and in liquid manure.

Use of Basic Slag on Grass Land.—The attention of farmers in the eastern counties is directed to the interesting results obtained by Mr. G. Scott Robertson in Essex from the use of basic slag on grass land. As is well known there are several grades of slag, and Mr. Robertson's object was to find out what difference existed between one and another. Broadly speaking, it appears that the high-grade slag is on the whole the best material to use, but it is approached very closely by the lower-grade slags, especially when these are used at a rate to ensure the application of sufficient phosphoric acid per acre. It would be unreasonable, for example, to expect 5 cwt. of a 20 per cent. slag to be as effective as 5 cwt. of a 40 per cent. slag, and yet this is sometimes expected. The proper method is to allow for the percentage of phosphate in the slag in deciding what dressing to give, regarding 10 cwt. of the 20 per cent. slag as the true equivalent of 5 cwt. of the 40 per cent. slag.

Perhaps the most striking feature of the results is the fact that the slag has acted well on the Essex grass land in spite of the prevailing dryness. The rainfall is low, the soils are not wet, and yet the slag has proved effective. This is shown not only by the yields, but to a remarkable extent by the botanical analysis of the herbage. On the unmanured grass land only about one-third of the soil is covered with grass and clover; of the remainder nearly half the surface of the soil is bare, and about a quarter is covered with weeds. On the slagged land, however, practically the whole surface is covered—half of it with clover, the remainder mainly with grass and with only a small proportion of weeds.

A further interesting result is that finely-ground mineral phosphate gives satisfactory results on grass land, and can be used if slag proves unobtainable.

Although it is not usual to apply slag as late as this, farmers will do well to examine their grass land closely during the present season, and ascertain whether they should not apply slag early next autumn.

COMPOUND MANURES.

FOR various reasons farmers frequently have recourse to compound manures supplying in greater or less degree most of or all the food constituents required by plants. In such circumstances the farmer can either purchase the ingredients of the mixture and mix them himself, or he can request a reliable manure merchant to compound a mixture according to his (the farmer's) specification. The farmer knows the manurial requirements of his own land better than the merchant; or if he is not certain on this point he can seek the aid of the agricultural organiser of his county, who is specially qualified to advise and who has a knowledge of local conditions. It is probably more economical for the farmer to do his own mixing, as he can employ his men on this work at slack periods and avoid the charge for mixing made by the merchant.

Manures which may and may not be mixed.—Sulphate of ammonia or other ammoniacal manure must not be mixed with any manure holding free lime, such as basic slag and basic superphosphate, nor should it be mixed with precipitated phosphates or with manures containing much carbonate of lime, such as Belgian and Algerian phosphates. The result of making such a mixture is the liberation of free ammonia, the presence of which, in the air, can be detected by its pungent odour. Sulphate of ammonia may, however, be mixed with superphosphate, bone manures, fish meal, nitrate of soda, salt and most forms of potash. Mixtures of sulphate of ammonia and superphosphate, or both of these along with salt and kainit, if not sown soon after being made, become moist and pasty; this, however, can be obviated by including in the mixture a drying manure such as bone flour, fine bone meal, or castor meal to the extent of at least 1 in 10.

Nitrate of soda should not ordinarily be mixed with superphosphate or dissolved bones; not only may such a mixture

result in the loss of some of the nitrogen, but the mass is apt to become sticky and difficult to sow. The addition of a considerable proportion of drying manures, such as a fine bone meal or steamed bone flour, will remedy this. Nitrate of soda may be mixed with salt or any potash manure without bad result. It may also be mixed with basic slag and raw mineral phosphates, but this mixture should be used at once and not stored.

Nitrolim may be mixed with basic slag, bones, or with any potash manure; and it may also be mixed with good, dry samples of superphosphate, although in this case a little heat may be developed and part of the water-soluble phosphate may be "reverted." Nitrate of lime is not suitable for making mixtures.

Superphosphate should not ordinarily be mixed with basic slag, precipitated phosphate, or ground mineral phosphate, as this results in the soluble phosphate of the superphosphate becoming insoluble in pure water (though readily soluble in soil water) to an extent dependent upon the lime present. On the other hand, bone flour and bone meal produce no such effect unless the mixture is allowed to lie for a long time, while they produce a dry, powdery mixture with the acid manure. Nevertheless, slag and superphosphate are frequently mixed for the reason that the mixture sows better than either ingredient alone and because any disadvantages that superphosphate may have on account of its acidity are removed. A better mixture is obtained by using steamed bone flour instead of slag.

How to mix Manures.—In making mixtures the ingredients should be very thoroughly incorporated in small quantities.

Lumpy manures, before mixing, and the mixture when made, should be passed through a sieve and the remaining lumps carefully broken up. If the mixture is not to be sown immediately it should preferably not be bagged at once, owing to its tendency to set immediately after mixing, but should be allowed to lie in a heap for a few days, after which it may be broken up, turned through a riddle or harp, and then bagged. After this treatment the mixture will not readily set or become lumpy, and may be kept for weeks. The most important point is always to mix systematically in small quantities.

General Mixtures.—Examples of general mixtures adapted for average conditions are given below for the different farm crops; other mixtures may be cheaper or more suitable in particular cases. The total quantities stated should be sufficient for one acre under average conditions. Other manures can be mixed together to give approximately the same composite

analyses, but only such as do not interact on each other chemically should be used for this purpose (see above).

In each case the percentage composition of the mixture has been ascertained by multiplying the weight (in cwt.) of each manure by its content of nitrogen, phosphate or potash, as the case may be, and dividing by the total weight of the mixture. The manures used are sulphate of ammonia containing 20 per cent. of nitrogen, superphosphate containing 30 per cent. of soluble phosphate, steamed bone flour containing 1 per cent. of nitrogen and 60 per cent. of insoluble phosphate, and sulphate of potash containing 49 per cent. of potash. Maximum selling prices have been arranged for potash manures and sulphate of ammonia, particulars of which are set out in circulars F.P. 501/S1 and F.P. 495/S1. Copies of these circulars may be obtained on application to the Ministry at 72, Victoria Street, London, S.W. 1.

Wheat, Oats, Barley.—For application at seed time, or early spring for wheat after a corn crop and not yet manured—

Sulphate of ammonia, $\frac{3}{4}$ cwt. = $\frac{3}{4} \times 20 \times 4/13 = 4.6$ Nitrogen.

Superphosphate, $1\frac{1}{2}$ cwt. = $3/2 \times 30 \times 4/13 = 13.8$ Sol. phosphate.

Steamed bone flour, $\frac{1}{2}$ cwt. = $\left\{ \begin{array}{l} \frac{1}{2} \times 1 \times 4/13 = .1 \text{ Nitrogen.} \\ \frac{1}{2} \times 60 \times 4/13 = 9.2 \text{ Insol. phosphate.} \end{array} \right.$

Sulphate of potash, $\frac{1}{2}$ cwt. = $\frac{1}{2} \times 49 \times 4/13 = 7.5$ Potash.

The percentage and composition of the mixture is, therefore :—
4.7 nitrogen, 13.8 soluble phosphate, 9.2 insoluble phosphate, 7.5 potash.

Mangolds.—For application at seed time—

		<i>Per cent.</i>
$1\frac{1}{2}$ cwt. Sulphate of ammonia ..	} containing	Nitrogen 5.7
$2\frac{1}{2}$ „ Superphosphate ..		Sol. phos. 14.3
$\frac{1}{2}$ „ Steamed bone flour ..		Insol. phos. 5.7
$\frac{1}{4}$ „ Sulphate of potash ..		Potash 7.0

In addition it is advisable to apply *separately* about 4 cwt. per acre of common agricultural salt.

Swedes, Turnips.—For application at seed time—

		<i>Per cent.</i>
$\frac{3}{4}$ cwt. Sulphate of ammonia ..	} containing	Nitrogen 3.0
3 „ Superphosphate ..		Sol. phos. 17.1
1 „ Steamed bone flour ..		Insol. phos. 11.4
$8\frac{1}{2}$ „ Sulphate of potash ..		Potash 4.7

Potatoes, Carrots.—For application at planting and seed time—

		<i>Per cent.</i>
$1\frac{1}{4}$ cwt. Sulphate of ammonia ..	} containing	Nitrogen 3.9
$3\frac{1}{2}$ „ Superphosphate ..		Sol. phos. 16.2
$\frac{1}{4}$ „ Steamed bone flour ..		Insol. phos. 7.0
1 „ Sulphate of potash ..		Potash 7.5

Beans, Peas, Lucerne, Sainfoin.—For application at seed time for beans and peas, and as a spring top-dressing for lucerne and sainfoin—

		<i>Per cent.</i>
$\frac{1}{2}$ cwt. Sulphate of ammonia ..	} containing	Nitrogen 2.0
$3\frac{1}{2}$ „ Superphosphate ..		Sol. phos. 19.1
1 „ Steamed bone flour ..		Insol. phos. 10.9
$\frac{1}{2}$ „ Sulphate of potash ..		Potash 4.5

<i>"Seeds" Hay.</i> —As for oats. For application in early spring.			
<i>Meadow Hay.</i> —For application in early spring—			<i>Per cent.</i>
1 cwt. Sulphate of ammonia ..	} containing	Nitrogen	4.5
2½ „ Superphosphate ..		Sol. phos.	16.7
½ „ Steamed bone flour ..		Insol. phos.	6.7
½ „ Sulphate of potash ..		Potash	5.4

The main object of introducing steamed bone flour into the mixtures is that it may act as a "drier" and thus facilitate distribution. Fine bone meal or castor meal might be used instead, with similar effects.

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FARMING OF THE UNITED KINGDOM IN PEACE AND IN WAR: THE PLOUGH POLICY AND ITS RESULTS.*

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WHITE races, especially the peoples of the British Empire, Central Europe, and the United States, largely increased their consumption of meat in the period between the Napoleonic and the Great War. From the standpoint of economy in food this has been an expensive change, since the amount of human food that may be produced from the soil in the form of meat is much less than the quantity that may be produced in the form of grain and vegetables. It follows that for peoples who during war are compelled to live on a meagre diet, or who, in reaping war's aftermath, are required to restore civilisation and to study economy in personal expenditure, there is no better food policy than to return to the sufficient, if less attractive, diet of their forefathers. During the period of reconstruction and poverty that must follow war, as well as throughout the struggle itself, a prudent nation should adopt the motto "Down Horn, Up Corn," *i.e.*, they should reduce expenditure on the products of live stock and increase expenditure on the direct products of the soil.

This may seem to be a strange motto for a year, characterised so far as British agriculture is concerned, by higher prices for cattle than have ever been known before, and it must in particular appear strange to the farmer, whose experience in

* An address delivered to the Agricultural Society, University College of Wales, Aberystwyth, on 19th December, 1919.

the past half century has taught him that the converse motto "Down Corn, Up Horn" has saved him from financial ruin.

It would ill become me to condemn the farming policy which has been adopted by British agriculturists since the "'seventies." It was a system of husbandry well adapted for a rich country ready to pay for all the beef and mutton that could be produced, well adapted, too, for a nation that took cheapness, not certainty of supply, as the gauge of a satisfactory food policy, and that regarded the soil as raw material for the creation of wealth, not as a storehouse from which ample stocks of food might be provided.

Moreover, our recent system of farm management fitted in with the commercial policy of the Nation; during the past 50 years Britain cultivated the resources of the sea as steadily as she neglected the resources of her home land. When, after the disastrous harvests of the late "'seventies," stock-farming began to supplant corn-growing, grain was a commodity which could easily be carried in ships; but meat could not, and live cattle were indifferent occupants of cargo space. By transferring our corn-growing to other lands we were not only saved the necessity of tilling our own fields, but we provided valuable merchandise for sea transport and a convenient commodity for which our manufactured goods could be bartered. There were, therefore, reasons which appealed to others than farmers for abandoning tillage, for importing bread corn, and for producing meat at home.

It is true that before the outbreak of war the early position had been modified by the development of the trade in chilled and frozen meat; but meat production had secured a strong hold on the British farmer and the quality of home-fed meat on the British public. Thus when war broke out stock-farming was universally admitted to be not only the paramount British industry, but to be the only type of farming worth serious consideration in most parts of the country.

Methods used in estimating the Food Requirements of Nations.—

I shall presently contrast the importance of stock-farming and corn growing as it existed before the War: but let me first allude to the methods used in estimating the food requirements of nations and the food-producing capacity of cultivated land.

The policy specially associated with the Food Production Department came as a shock to the average agriculturist. He could not understand the actions of those whom he termed

the "plough maniacs." To him it seemed as if the emissaries of the Department were bent on destroying a sure and certain supply of food in search of problematical advantages. "Are not beef and mutton," he asked, "as necessary foods for men and women as wheat and oats." ? "When our children cry for milk can we offer them potatoes." ?

In adopting a plough policy, it may here be remarked, the Food Production Department were not forgetful of the commercial advantages of stock-farming on grass land ; but in facing the conditions imposed by war, their problem was to secure the largest possible amount of human food from the soil of the country. In giving effect to this policy they were limited by scarcity of labour and manure, and it was, therefore, necessary to adapt their methods to the special circumstances of the time and to neglect the less important question of farming profits.

In ascertaining the food needs of a whole country, the total requirements may be estimated by different methods. In pre-war times, when the country could import what it wanted, it was merely necessary to purchase the number of tons of beef, mutton, wheat, sugar, butter, etc., for which there was an effective demand, but, on the outbreak of war, these commodities could not be secured in unlimited quantities, and, as the War progressed, ships could not be provided to carry all the foodstuffs that could be purchased in other countries. We had, for example, to substitute margarine made from West African palm-nut kernels for Danish butter, and American maize for Australian wheat. In feeding the human population we had, therefore, to adopt the methods familiar to farmers in connection with the preparation of rations for live stock, and to provide from the best available sources the essential proteins, fats and carbohydrates required in food.

In dealing with a large mixed population, so long as a sufficiency of bread, margarine and milk can be assured, the best means of comparing the value of one foodstuff with that of another is to determine what is known as the "energy value." Most of the food which is eaten is burnt up in the body, just as fuel is burnt up in the furnace of a boiler, and in "burning" it produces energy which maintains such vital processes as the movement of the muscles, the circulation of the blood, and digestion. As the result of the food eaten, work is done by the body, just as work is done by a locomotive because of the energy released from the coal consumed in the furnace.

The unit employed to measure "energy value" is the Calorie, that is, the quantity of heat needed to raise 1 kilog. of water from 15° to 16° C.

The number of Calories which must be supplied in food depends chiefly on the nature of a man's work. When resting in bed, and it is only necessary to maintain the vital functions, it has been found that a man of average weight uses up about 1,850 Calories per day. If engaged in very light work, *e.g.*, walking to a classroom and listening to lectures, not less than 2,500 would be required; assuming a normal amount of exercise 3,000 to 3,500 would be necessary. In hard training the potential "blue" may need 5,000, or more.

Before the War the average amount of food provided per man in the United Kingdom would supply about 3,400 Calories per day, or, including women and children, about 1,130,000 per head per annum for the whole population of the country. For purposes of calculation, we may take the round figure 1,000,000 Calories per person per annum as representing the needs of a mixed population in the United Kingdom.

Chief Farm Products of the United Kingdom.—We may now proceed to study the agriculture of the United Kingdom as it existed before the War, for the purpose of discovering the relative money values and food values of the crops and live stock which we then produced.

In Table I. (p. 1196) I have brought together the necessary data. The figures are the annual averages for the five-year period, 1909-13. Prices are given per customary unit, *i.e.*, per qr. of wheat, per cwt. of meat, butter, etc., and per gal. of milk; the weight sold is shown in thousands of tons; the money value in thousands of pounds; and the energy value in millions of Calories. The upper part of the table gives details, the lower presents a summary.

It is apparent at a glance that in the United Kingdom live-stock farming was paramount. It may be shown that 36,000,000 acres were devoted to producing meat and milk as against 2,950,000 to the growing of wheat and potatoes. The sales of live stock and of stock products totalled some £151,000,000 per annum, while wheat and potatoes produced £26,750,000 only.

The entire food supply of our live stock is not, however, produced from the soils of the country. We import feeding stuffs for which farmers paid some £32,000,000 per annum in 1909-13. These feeding stuffs have considerable manurial value, and we may write off £6,000,000 as the sum due for

manure by the land used for raising other saleable products than live stock. This would indicate the value of the live stock and live-stock products of the United Kingdom to be £125,000,000 per annum in the period 1909-13.

It may be remarked in this connection that the trade in exporting cattle and sheep, though valuable to those engaged in it, was relatively very small in the period under review.

Let us now turn our attention to examining the returns *per acre* in money and food which we get from the land of the United Kingdom.

When for "total value" we substitute "value per acre" there is less reason for the complacency with which we have hitherto regarded the results of our live-stock farming. When

TABLE I.—YIELD AND VALUE OF THE CHIEF FARM PRODUCTS OF THE UNITED KINGDOM, 1909-13.

Column 4 includes the value of by-products—Hides, Wool, Potatoes used for Feeding, etc.

Product.	Price.	Quantity Sold.	Money Value.	Energy Value.
		Tons.	£	C.
		000	000	000,000
Wheat (1,800,000 acres) ..	32s.	1,393	12,000	3,600,000
Potatoes (1,150,000 acres)	70s.	4,000	14,750	4,000,000
Beef and Veal	57s.	810	52,000	2,380,000
Cattle Exported	—	—	196	—
Mutton and Lamb	62s.	326	25,000	1,072,000
Sheep Exported	—	—	59	—
Pork, Bacon, Ham	63s.	400	25,000	1,814,000
Milk	8d.	4,430	32,000	3,220,000
Butter	130s.	112	14,580	900,000
Cheese	73s.	29	2,150	116,000
	—	—	178,000	17,100,000

SUMMARY AFTER DEDUCTING THREE-FOURTHS OF VALUE OF IMPORTED FEEDING STUFFS.

	Acres.	Money Value.		Energy Value.	
		Total.	Per Acre.	Total.	Per Acre.
	000	£000		C.	C.
				000,000	000,000
Wheat, Potatoes	2,950	26,750	182s. 9d.	7,600,000	2'576
Live Stock	36,000	125,000	69s. 5d.	8,000,000	'222

a deduction for imported feeding stuffs has been made we find that the receipts from live stock come out at about 69s. 5d. per cultivated acre (the very considerable value of the stock grazing, some 15,000,000 acres of mountain and heath land, has been thrown in) as against 182s. 9d. per acre realised from wheat and potatoes. When, further, we examine the energy value of the products raised, the relative importance of stock and of crop farming takes an entirely new aspect. Whereas the energy value of the former is but .22 million Calories per acre, the energy value of the latter amounts to 2.57 million. In other words the meat, milk, etc., produced by 100 acres devoted to stock farming would supply energy for 22 persons for a year, while 100 acres cropped with wheat and potatoes in the proportions indicated in Table I. would provide a supply for 257 persons.

A few additional figures indicating the production of energy by common crops may be of interest in this connection.

If the average yield of our crops be taken, it may be shown that each 100 acres under crop would provide energy for the following numbers of persons: Wheat about 200, potatoes 400, oat 150, mangolds converted into meat 40, meadow hay converted into meat 12 to 14. If, further, we assume a farm to be worked on a six-course rotation—wheat, potatoes, oats, roots, barley, clover—it may be shown that, per 100 acres, energy for about 150 persons could be produced; on grass land of average quality, half producing meat and half milk, the corresponding figure would lie somewhere between 15 and 20.

Production on Ploughed Land and Grass Land.—Some years ago in giving evidence before Lord Selborne's Reconstruction Committee, I estimated that before the War the ploughed land of the country was feeding 84 persons per 100 acres, while the grass land was probably feeding about 20. From the figures in Table I. above, it would seem that this estimate of the production of grass land was too high. At that time I calculated the yield from grass by three methods, which gave the figures 17, 20 and 21 respectively. Table I. indicates that the joint produce of some 14 million acres of arable land and some 22 million acres of grass provide energy for 22 persons per 100 acres. I have not actually calculated the respective shares of the grass and arable, but if this were done it would be found that the figure for the number of persons maintained by 100 acres of average grass land before the War was nearer 17 than 20.

In this connection I should explain that the figures showing meat production in the period 1909-13 are based on the official figures of the Ministry of Agriculture and the Board of Trade. The experience of the Ministry of Food points to the conclusion that we have over-estimated our pre-war home meat supply.

The Population maintained by British Soil.—The changes in our system of farming in the past 50 years have had one result which I believe few among us have realised. It is that, in spite of the great advances made by British farmers between the close of the Napoleonic wars and the depression of the late 'seventies, the population we were feeding from our own soil in the period 1909-13 was little greater than it was a century before, and it was substantially less than it was 75 years ago.

In the period 1801-10 the soil of the United Kingdom fed about 16½ millions, and in the period 1831-40 about 24½ millions, while in 1909-13 I estimate the number to have been 17½ millions. The standard of living had, of course, much advanced by the beginning of the 20th century; beef and mutton were more plentiful, oatmeal and potatoes were less in evidence; but in spite of this change in the quality of the food British agriculture has no reason to be proud of the results of her efforts to maintain the British people. It is true that the British people did not ask to be supplied with food from their own land, and more and more relied on imports; thus they entered on the World War with a supply of home-grown food that would last them from about 6 p.m. on Friday till 10.0 a.m. on Monday in each week. Nor is there, it may be remarked, any substantial change to-day; we are more or less cheerfully, according to our dispositions and our knowledge, or want of knowledge, facing a world situation which, in the matter of food production, no one can forecast, with a week-end supply assured from our own land.

The Plough Policy.—It was generally known that the greater part of Britain's food supply came from overseas, but in 1914 it was not generally realised that from the products of our own soil we were feeding a population very little larger than the population which the land of the country maintained a century before. Nor was it realised that this state of affairs was largely caused by the system of husbandry which our farmers were forced to adopt because of the depression of the late years of the 19th century.

In September, 1915, in a paper read before the Manchester Meeting of the British Association,* I contrasted the effects which the adoption of different systems of farming had upon the nation's food supply, and from time to time thereafter I urged the importance of breaking up grass land; but, though a plough policy was widely advocated in the autumn of 1915, no active steps to secure the ploughing up of grass land were taken.

In 1916 in a Memorandum on "The Recent Development of German Agriculture"† I contrasted the farming system of Britain and Germany in their effect on food supply, and indicated that our enemy was able to feed about twice as many people per 100 acres as we were, and that this was not due to the larger crops grown in Germany, but to the greater area under tillage. The lessons of this contrast were enforced by the position of our food supplies at the time.

The year 1916 was a disastrous one from the standpoint of the Allies' food. The wheat crops of North America and the potato crops of Europe were very poor. It was clear by the autumn of the year that there would be a great shortage of both bread stuffs and potatoes in the following season. Potatoes, indeed, were very scarce as early as November, 1916.

Immediately after the change of Government in December, 1916, the new President of the Board of Agriculture (Mr. Prothero) decided to set up a special Department of the Board to promote the interests of food production. In January, 1917, the Food Production Department started its existence at 72, Victoria Street, and the new Agricultural Executive Committees began work in their respective counties. During the month the food outlook grew steadily worse, and public interest in food production was thoroughly aroused.

Good progress was made by the movement, and even in 1917 substantial additions to the area under corn and potatoes in England and Wales were secured. But by the spring of 1917 farmers had already, for the most part, settled their cropping for the year, and it was recognised that no great increase in production would be possible until the following season. Attention was, therefore, concentrated on preparations for the harvest of 1918.

In the first place, estimates were made of the greatest area which could be got under tillage assuming all conditions to be favourable; a programme for each county was then

* See this *Journal*, September, 1915, p. 520.

† " " " August, 1916, p. 426.

drawn up ; and a survey was arranged and estimates were made of the men, horses, and machinery that would be required to carry out the programme. Needless to say there were very great difficulties to be surmounted, both by the Agricultural Executive Committees in finding the land and by the central Department in securing labour, machinery and supplies. I do not, however, propose to dwell on our methods or our difficulties, but to pass on to the results.

Table II. shows the change in the cropping of England and Wales in 1918, as compared with the pre-war period 1905-14 ; figures for 1871-75 are also given.

From this Table it will be seen that the " average 100-acre farm " of England and Wales had 44 acres under crops other than grass and fodders in the 'seventies, that this area fell to 31½ acres before the War, but that in 1918 there was a sharp recovery, and the average farm had 38 acres under tillage. The area under corn in 1918 was only 1 per cent. less than it

TABLE II.—ENGLAND AND WALES.

Crops and Live Stock per 100 acres of Cultivated Land.
(The " average " 100 acres of Cultivated Land has, in addition,
14 acres of Hill Pasture available for Stock Raising.)

	1871-75.	1905-14.	1918.
Permanent Grass	44·4	58·4	54·0
Rotation Grasses, Clovers, Sainfoin, Lucerne	11·5	10·1	7·9
Total Grass and Clover	55·9	68·5	61·9
Cereal Crops	27·2	19·6	26·2
Including Wheat	12·8	6·4	9·5
Beans and Peas	3·3	1·6	1·5
Potatoes	1·4	1·6	2·3
Turnips, Swedes, Mangolds	7·4	5·7	4·9
Cabbage, Rape, Vetches, etc.	2·5	1·8	1·7
Bare Fallow	2·3	1·2	1·5

STOCK.

	1871-75.	1905-14.	1918.
Agricultural Horses (including Colts)	4·2	4·7	4·3
Cow and Heifers in Milk or in Calf ..	6·8 } 17·6	8·6 } 21·3	9·6 } 23·0
Other Cattle	10·8	12·7	13·4
Sheep	81·4	68·6	61·0
Pigs	8·7	8·7	6·3

was before the depression, and the area under potatoes was 1 per cent. greater. If we take the crops chiefly grown for human food—wheat and potatoes—we find 12 acres on the average 100-acre farm of 1918, as compared with 8 acres before the War and 14 acres in the period 1871-75.

In the early part of 1918, however, no criticism of the work of the Food Production Department was more familiar than that "acres" were being sought after at the expense of "bushels," and quite a number of our critics prophesied that when, after harvest, the gains and losses were reckoned up, the net result would be trifling.

Let us, therefore, compare the harvest figures of 1918 with those of the pre-war period of 1905-14. Figures, based upon the Agricultural Returns, are given in Table III.

TABLE III.—ENGLAND AND WALES.

Production of Grain and Potatoes, 1905-14 and 1918: Figures in thousands of tons.

Crop.				Total Yield.		Increase or Decrease (—) in 1918.	
				1905-14.	1918.		
						Weight.	Per Cent.
Wheat	..	..	..	1,534	2,339	805	52
*Barley	..	..	..	1,190	1,228	38	3
*Oats	..	..	..	1,457	2,056	599	41
Rye	..	..	..	25	63	38	150
Beans	..	..	..	243	206	—37	—15
Peas	..	..	..	115	100	—15	—13
Total Grain	..	..	..	4,565	5,993	1,428	31
Potatoes	..	..	..	2,678	4,209	1,531	57

From the figures in this Table it will be seen that in the last year of the War (favoured, it should be remarked, by a season better than average) England and Wales produced 52 per cent. more wheat, 41 per cent. more oats, 31 per cent. more grain of all kinds, and 57 per cent. more potatoes than on the average of the period 1905-14. Reckoning potatoes as equal to one-fifth of the weight of grain, the increase in grain crops and potatoes equalled some 1,733,000 tons.

The root and hay crops of 1918 occupied a smaller area and were lower in yield than the average, and, assuming the reduction to have been borne by beef and mutton (not by milk and

* In 1918 "mixed corn" was "returned" for the first time. The estimated yield was 620,000 qr. As "mixed corn" consists chiefly of barley and oats the produce has been added to the barley and oat crops of 1918 in equal amounts.

pork) we may have lost, because of this shortage in fodder (but probably did not lose) as much as 100,000 tons of meat. After making a deduction for this loss, the net gain in 1918 represented 1,633,000 tons of human food. To bring this food into the country it would have been necessary to charter vessels having an aggregate capacity of 2,300,000 shipping tons of 40 cubic feet.

These changes, it will readily be understood, were not secured without a very great deal of work which fell not only upon farmers themselves and their men, but also on members and officers of the Agricultural Executive Committees, and on the staff of the Food Production Department.

The following figures will indicate the scale on which the Central Department was organised. Starting with some 30 permanent officers of the Board of Agriculture and Fisheries, a staff of about 1,000 was employed in 1918. Before the end of 1918 the controlled labour supplied to Agricultural Executive Committees through the Department included 118,000 persons, of whom 72,000 were soldiers, 30,000 prisoners of war, 4,000 war volunteers, and 11,500 Land Army women. By this time, too, the Department owned 4,200 tractors and 10,000 horses, with many thousands of implements and sets of harness. In addition a great deal of work was done in supplying fertilisers, distributing seeds, and providing such necessities as binder twine.

The cost of all this work was necessarily high, but there was much more than a direct return in the value of the extra crops secured; crops which, but for the action of the Department, would never have been grown: and, needless to say, it was not for a pecuniary profit, but as an insurance against the risk of starvation that the Department was established.

Could the United Kingdom become self-supporting?—It is sometimes stated that given suitable encouragement by the State, and an ample supply of machinery and manures, the soil of this country might provide us with all the bread-stuffs we require, and at the same time maintain the present production of milk, beef, and mutton.

Let us examine this view, first, as a Peace proposition. Assuming that by good farming we could not only largely extend the area under corn, but maintain the existing average production of the soils of the United Kingdom, the figures in Table IV. show the area that would be required to provide us with all the cereal grain (except rice and certain millets) used in the United Kingdom in the period 1909-13.

TABLE IV.—AREA NECESSARY TO GROW ALL THE CORN USED IN THE UNITED KINGDOM.

Maize replaced by other Cereals. Rice and Millets omitted. Land assumed to produce an average crop of the period 1909-13.

—	Wheat.	Barley.	Oats.	Rye.	Total.
	Tons. 000	Tons. 000	Tons. 000	Tons. 000	Tons. 000
Grain or Flour, etc., as Grain Imported, 1909-13	5,805	1,070	948	49	7,872
Maize equivalent	292	1,240	1,056	—	2,588
Addition for Seed	677	192	143	4	1,016
Total extra Grain required	6,774	2,502	2,147	53	11,476
	Acres. 000	Acres. 000	Acres. 000	Acres. 000	Acres. 000
Area wanted for extra Grain	7,527	3,127	3,006	67	13,727
Area in United Kingdom, 1909-13	1,887	1,845	4,040	62	7,834
Total Area necessary ..	9,414	4,972	7,046	129	21,561

In the Table I give the weight of wheat, barley, oats and rye imported in the average year of the period 1909-13. As maize cannot be grown here, it has been replaced by other cereals. I have assumed that one-eighth would be replaced by wheat, half by barley, and three-eighths by oats. I have next added the quantity of seed that would be required to produce the imported grain, and I arrive at a figure of 11,476,000 tons as representing the total extra requirements of cereals. It would take 13,727,000 acres to grow this weight of grain, and adding the 7,837,000 acres already under white crops we arrive at a figure of 21,564,000 acres, as the total area that would be wanted if the United Kingdom were required to grow its own corn. The present average yield could not be maintained on so large an area, if we had to depend on the varieties of wheat, etc., now available; but assuming that the difficulty of maintaining the average yield were overcome, we should still have to hunt for suitable land. Continuous corn growing we may put out of consideration, except in certain parts of the Eastern and South-Eastern Counties, and if I were ordered to grow 21½ million acres of corn in the United Kingdom I would demand for the purpose some 43 to 45 million acres of arable land; otherwise it would be impossible, however great were my resources in labour and capital, to maintain the land itself in a reasonably good state of cultivation. But there

are less than 47 million acres of cultivated land available altogether. So that the task of finding 43 millions for the purpose would clearly be impossible.

But let us examine a more practical question. Assuming that the United Kingdom were engaged in another great war, that stocks in hand and imports could supply bread-stuffs until after the second war harvest and that, profiting by the experience of 1914-18, immediate steps were taken to increase production, could the country be starved into surrender? There may never again be such a war as that which we have experienced, and if there were we cannot predict what size of population the soil would be called upon to support; but the answer is still worth attempting while the experience of 1918 is fresh in our memories.

To provide the minimum rations of bread that would be required to maintain the present population of the United Kingdom in health, and in addition to provide small rations of grain for farm horses, cows and other essential live stock, it would be necessary to grow about 14 million acres of corn. The approximate cropping of this area would be:—

5,000,000	acres of wheat	}	for human bread-stuffs, meal, etc.
2,500,000	„ barley		
3,000,000	„ oats		
3,000,000	„ oats ..		for live stock.
500,000	„ barley		for brewing or munitions.

In the year 1918 Ireland grew 1,933,000 acres of corn. In any future war, as in 1914-18, the live-stock and potato industries would be likely to receive closest attention, we might put the Irish contribution to the total grain area at 2,000,000 acres. It would thus be necessary to secure 12,000,000 acres within Great Britain. The actual area grown in 1918 was: England and Wales, 7,080,000 acres; Scotland, 1,370,000 acres; or 8,450,000 acres in all. This would leave the authorities the formidable, but, in my judgment, by no means impossible, task of securing in the second season after the outbreak of hostilities $3\frac{1}{2}$ million acres more corn than Great Britain grew in 1918.

THE FAREWELL RALLY OF THE WOMEN'S LAND ARMY, AND A RETROSPECT.

N. FRIDA HARTLEY.

THE 27th November last marked the return to more normal labour conditions in agriculture by a Final Rally of the Women's Land Army. It was held in the Drapers' Hall, London, where Princess Mary presented Distinguished Service Bars to 57 women, all of whom had won their honours for deeds of bravery or special skill or devotion in their duties.

Those who were present received a very forcible impression of the high standard of physical strength in the women and of their general appearance of freshness after their hard service. These massed groups of girls from the counties represented a page in the history of agriculture and an epoch in their own working lives. If it is contended that they were a picked lot and stood for the flower of the Land Army, it must also be remembered that, coming in the first place from all classes of industrial life, many of them had been made or had made themselves what they are to-day.

The two and a half years of the life of the Land Army, may be said to border on romance. The scheme appeared as one item in the National Service programme of 1917, without precedent and without any assurance of success. It was built up in doubt, launched in a sea of opposition, and had perforce to sink or swim on its own entirely untried merits. Its romantic element comes in a peculiar triumph of its own, which it has gained by its own struggle against obstacles and because it has in the end achieved so much more than its own original intentions of providing a stop-gap for labour shortage.

It is fully recognised by now that during its lifetime two time-worn notions, both strangely contradictory one to another, have decayed and crumbled into ruins; one, that this land work which the women have found to be so worthy a thing, was beneath female dignity, and the other that agriculture, in which they have found so good a place, covers at the same time too robust a field of knowledge and makes too large a demand on physical strength to find a place for their finer perceptions and powers of mere personal devotion. The breaking down of the barriers and the discovery that, after all, this fineness of perception and power of devotion were,

to a remarkable degree, adaptable to certain aspects of farm life, and the consequent opening out of a new career to women with pluck and determination, may be called the professional triumph of the Land Army.

But there are other and more human issues none the less valuable, and one felt that it was essentially the human and individual point of view that was touched upon that night of farewell. The atmosphere, as one by one the women walked unostentatiously up the dais to receive their honours, suggested to those who understood the needs of the working girl nothing so much as a great awakening and a great renewal. It was charged with hope and with infinite possibilities for her future as well as of her present triumph against odds. The hope indeed touched upon other results of the great struggle made by women on behalf of women than one newly-opened career, and suggested for the years to come a raising of the whole status of the industrial class of working women, and of new efforts to be put forth by those who had the results of her training before their very eyes that night of commemoration.

For those who knew the conditions under which the poorer class of girls worked before the War have been literally amazed, not at the change that had been made in them—for they had long ago realised the good stuff they had in them—but the rapidity in which this change had been brought about. The loafer and the unintelligent factory hand have left inconsequence and apathy behind, and from the mere wage-earner had developed into the enthusiast. One has only to know one or two cases to realise how wonderful this transformation has been. Patriotic instincts, for the most part unborn in this class of girl, gave keenness at the start and *esprit-de-corps* as time went on. The training and the individual care filled as large a blank in the life of the poor worker as she and her kind had done in the labour shortage, and their hope lay also in the new knowledge of those who had not realised this before. There had been something else in the making of the successful land girl than the freshness of open-air life and the mysterious contact with Nature which has power to touch the fundamental in the human being. The mere dealing with the Natural elements without the accompanying use of the brain and the perceptions is apt to dull, and it was because the land girl has been inspired at the start to work with a purpose and an ideal, that her development was so sound, and her progress so marked. The new effort literally kindled her into life.

And there was another side to the picture that night, for it touched upon the best of things by which, after all, all hopes of progress must be judged. One felt with all the inevitable jars which had attended the administration, and the acceptance of so unprecedented a scheme, the entrance of the young Land Army girl into the somewhat tired agricultural world, with her Women Organisers behind her backing her for every ounce she was worth, and the girl, herself ignorant as she was full of the eagerness and of the appeal of youth, had really had a remarkably refreshing and humanising effect upon agricultural conditions and upon the British farmer himself. The writer, hailing from a county where a certain dry kindly humour is often the saving grace of a temperament stifled by hard conditions and labour, is convinced that the very troubles of the new worker, the absurd happiness of her, the whimsicality, and, in short, the utter unexpectedness of her, had the most wholesome effect of all from a human point of view upon the older-fashioned men !

That the advent of this whimsicality and this unexpectedness would have caused an outcry indeed in the farming world which has, perforce to take itself very seriously, had it not been accompanied by a steadily growing efficiency, goes without saying ! One shudders to imagine the results of the materialisation of the nightmare regularly dreamed by one of the oldest types of farmers : that a bevy of " finnickies, nonsensical ladies, with skirts held up and buttoned up boots," had, by order of the Government, invaded his farm, turning up their noses at his pigstyes, and his muck heap, spoiling by their dignified presence his after-dinner nap, smoke and joke. After long persuasion the dream of that farmer did materialise, but to his utter amazement it took the form first of a shy, eager trainee, in a dress which he would not have dared to contemplate before but of which he saw the peculiar suitability, and, after he had used a little patience, of a strapping, commonsense land girl who kept his yard and his pigstyes as he had never kept them, and was quite as ready for her joke and her smoke after supper as he was himself. He took great credit to himself for the result of his patience, but to the end he declared that she was addicted to tantrums quite peculiar to her sex which, together with his pride in her, so tickled his fancy and his sense of humour that he became a wiser and, strange to say, a happier man. The old-fashioned farmer has been blamed for prejudice at the start, and prejudice there undoubtedly was, but it was a natural sequence to old conditions, and to traditions which had more of dignity than is commonly supposed.

Much of his doubt was due to a perfectly natural sense of chivalry, and the dislike of the idea that a woman should have to do the rough work which his man had always done. In his opinion it was not the time for such considerations as better housing, a new standard of wages, and hours, and government interference. It must have seemed to many men that the demand for this consideration only proved his contention that general farm work was not suitable for women, except at seasonal times when they might be employed locally because he could not do without them. Then, when it was clearly explained to him that he could not even merely supplement his labour with organised and subsidised women labour but must accept the latter wholly with its attendant conditions, and when growing shortage compelled him to give up the idea that the scheme was instituted merely for the pushing of women into agriculture, he settled down and matters began to improve.

He soon began to see that if he was to get the best out of his girl he must give her a chance, give her time to do the all-important thing in the eyes of the small farmer—"get into his ways." In the North of England, at any rate, where a farmer's ways are very much his own and very little those of anyone else, this is the essential thing, and he began to use patience. With patience, if the girl was willing and had commonsense, came interest, and soon he began to watch her progress with a kindlier eye than merely to mark her increasing worth of her wage. It has been a joy to watch the growing companionship and understanding between some of the best of the women and their employers, and the way in which the latter have fallen in with the more individual and human outlook of the women. "That gell," remarked a farmer, leaning over his gate with his pipe in his mouth and watching his young worker handling calves with a sort of passionate deftness in her movements, "treats they calves as if they was babies instead of machines in the making, and blame me if I don't think they're the gainer all along. What there is in beasts she gets out of them, and that's a deal more than I ever thought to look for before."

Some very creditable all-round farm hands began to show themselves amongst the newly-trained girls, together with some extremely creditable milkers and stockwomen. Then there came those women who in the face of a storm of doubt and incredulity had specialised—the thatchers, the threshers and the tractor drivers. The thatchers could not be supplied fast enough, the threshers—a job which many of the farmers

stoutly declared to be far too hard for women—were fully employed, and there was no more popular work amongst the girls. The tractor drivers went ahead and took the field with honours, and interest grew stronger. There was amongst the women who received the Bar that night, one who had ploughed land which no man cared to touch, and yet she possessed, apparently, no undue measure of physical strength. Employers began to be convinced of a fact which the pioneers amongst them had contested all along, that although a woman could not take the place of a man in point of view of physical strength and a general day's work, she could in certain circumstances achieve by her quickness of perception and deftness of handling and by the very enthusiasm of youth, what he could or would not, and it was just there that the women began to rouse the honest recognition of the more backward employers. They saw that although her sphere of work on his farm might be limited, it was none the less valuable within its own scope. There is no more appreciative man than the British farmer if he feels that he is getting his money's worth and is not being imposed upon.

In one county where opposition to female labour had been very strong, a farmer used to watch the work of the tractor driver for hours and then go home very much more disposed to be patient with his own little struggling farm hand, and less inclined to dub the whole Land Army a "wash-out" because there had been a considerable number of failures. The progress of the Land Army had reached a stage where only a few signal successes were needed to turn the tide in its favour. Incredulity died a natural death, and those amongst the employers who had been the pioneers of the scheme began to breathe freely.

Failures! A whole chapter might be written on the subject of failures both from their own and from their employer's point of view. For the Organisers of the Land Army would be the first to recognise that the waste material must have been a sore trial to an overworked farmer during those first trying months. There were those girls who began badly, did not know how to use their new freedom or responsibility, and then tried again and became excellent workers. But there were others who could not regain the ground they had lost, or who had never had the backbone to stand a new test of any kind, and these, after unconsciously pulling down the prestige in their neighbourhood, themselves knew the bitterness of ignomious

discharge. There were many who tried and persevered and failed, not actually on medical grounds, but owing to lack of physical or nervous staying power. Has it ever been fully realised by those who took young girls from town surroundings, what a severe test to their nervous powers the new work and the strange surroundings constituted? Many of them were young enough in all conscience! Poor little failures of the Land Army; they were so inevitable! But it must be remembered that the greater number of the women came forward with good intentions but utterly without means of gauging their own powers of skill or endurance beforehand. But the country owes its debt of gratitude to all those who answered the call to National Service only to fail, and the Organisers recognising this, and having no funds or officers to meet the purpose, yet did what was possible to place these girls on a safe footing after their return, and will doubtless always be glad to remember that they did so.

The percentage of women released solely on medical grounds from April, 1917, to June, 1918, was found to be approximately 6 per cent.—an astonishingly small number considering the elements of uncertainty which had to be weighed in the balances against success. For what after all was the history of the beginning of the Land Army?

When the subsidising of the scheme was finally decided upon, the Organisers had absolutely nothing to draw upon either in the way of precedent or material. Now that the scheme has won its way and fulfilled its object, and now that women are about to take advantage of all that has been won for them, the stupendous task which the Organisers had before them should be remembered. The Director and those in council with her must have pondered long upon the distressing problem of how to make something grow out of nothing! There was no foundation for a staff, and it was a scheme which needed a specially gifted staff. There were no land girls on the scale required, and it seemed extremely doubtful whether women could or would leave their own homes and consent to be mobile, or, beyond the fact that women in certain parts of the country had worked at seasonal times and in a purely local way, that they would consent to do the rough work of the general farm labourer. The very fact that even this form of land work had been considered derogatory would seem to be against recruiting on any large scale. The workers must be drawn from the towns as well as from the country if a sufficient number were to be

raised, and the question of suitability was a very anxious one. Agricultural conditions in many parts of England were utterly unsuited to the sudden employment of women, and it seemed a bad time to ask farmers for a greater consideration in this respect. The rates of pay could but compete badly with those of most other war organisations, and volunteers could only be appealed to from a sense of patriotism or for love of work of which they had no previous knowledge. An important feature of the problem was the organisation of the voluntary workers all over the country for the stimulation of local labour—quite as important a feature of the scheme as the mobile force known as the Land Army. The Organisation in control of voluntary workers is always a difficult matter, and in most of the war services there has been no such element. One of the greatest obstacles which Miss Talbot—the Director of the Land Army—must have encountered was the utter uncertainty of the farmer as to the extent of the coming labour shortage, and the farmer is usually too harassed over actual problems to care to look far ahead.

The Organisers and those pioneers in the farming world to whom they owe so much must have lived and moved and had their being on hope and determination in those days, but in all branches of industry men were being called up and women were fitting themselves not by training alone but by actual experience to fill their places. Only a sudden turn of the tide of the War could avert the coming agricultural shortage, although farmers might be spared to the last. Determination merged into organisation, and organisation into action, and the rest of the unique history of the Land Army deals with the forced development for emergency purposes of the raw recruit into something as nearly approaching the finished article as possible, followed by the more normal growth of her own powers in such measure as she possessed them. Then the gradual absorption and adaptation of the whole scheme into the actual labour needs of the country, accompanied by steady progress which outpaced setbacks, a great deal of marked success, and finally the cordial acknowledgment of the adequacy of the Land Army as a whole. If women have, as farmers contended at the first, pushed their way into agriculture, they were called by patriotism and kept there by the grit and efficiency with which they filled the gap. The satisfactory fact has now been ascertained that 67 per cent. of the women have elected to work on under the Association. If they remain, as they

doubtless will, it will be because they have found a legitimate place which they may fill not as unwelcome competitors with men, but as fellow workers by means of their own particular gifts adapted to a new end. This is the legacy which Organisers and workers of the Land Army, in co-operation with the farmers, pioneers themselves, have left to women and to agriculture.

AGRICULTURAL HOUSING AND RENT OF COTTAGES.

THE following address was given by Lord Astor to the Agricultural Club at their meeting on 17th January, 1920 :—

I have come here to-night, representing the Ministry of Health, to speak to you respecting the necessity for providing the additional housing accommodation needed in this country ; but I hope you will realise that although I am principally concerned with housing, I am also deeply interested in agriculture. I can assure you that the Ministry of Health will constantly bear in mind the effects of their housing policy on agriculture and are very anxious to work in harmony and co-operation with the agricultural industry. In July last I met the Agricultural Wages Board and outlined to them the Government's housing policy. After an interesting discussion the matter was referred to the Cottages Committee of the Board for consideration. I notice that the Committee decided to postpone any decision on the matter, and because of that I have come here this evening to put to you the difficult points which I hoped you would solve.

In the first place, I think it necessary to have a few fundamental figures before us. The Ministry of Health's estimate of rural requirements was 100,000 houses at once. The total for the country was estimated at half a million. More recent returns show that 500,000 is an under-estimate, so that we may take it that 100,000 is the minimum rural requirement. There are also large numbers of inadequate houses and old cottages which must be replaced.

There is a real and urgent need for new houses. We want to get away from overcrowding, not only in the towns but also in the country. In the near future we must provide reasonable

accommodation for all our people. We must also bear in mind the fact that just as we desire to raise the standard of housing in the towns, so it is desirable to raise the standard in the country also. The families of agricultural labourers are on the average 16 per cent. larger than the families of the rest of the population, therefore the bedroom accommodation in rural areas should at least be as good as in the towns and cities. I emphasise this point because it has been said that the standard of housing laid down by the Ministry of Health is too high for the country ; but if we are going in for better housing then there is every reason why the higher standard should be applied in the country as well as in the town.

Now these 100,000 are not to be tied cottages, nor are they to be for the use of agricultural labourers only. In our opinion the bulk of these new houses will be in villages and hamlets. That will be a great advantage. It will facilitate the education of the children ; it will minister to the gregarious instincts of man ; it will permit of the provision of a better water supply and drainage. Moreover, the advent of the bicycle has made it possible for the agricultural labourer to live at some little distance from his work, which may be the case if the houses are built in the manner suggested.

The great difficulty with which we are faced at the outset is the cost of building. Cottages which might cost £350 before the War would now cost at least £700. We are so impressed at the Ministry of Health by the high cost of building that we are stimulating experiments with new methods of building and rediscovering old methods. We hope that in steel and concrete or pisé-de-terre we shall be able to build more cheaply in many districts. In some areas £100 to £150 may be saved by using these new or old methods in place of brick. Then also, the Government have put aside £15,000,000 as a subsidy, and we hope that landowners will come forward and join in providing houses with the inducement of the £150 subsidy for each house built within the next 12 months. We believe there is a nucleus of building labour in some rural districts which will not go to the towns but which could be brought in to help in the emergency. The effect of these high costs must be reflected in the rents of new houses, but before discussing rents I want to ask you to bear in mind a few facts which are apt to be put aside or forgotten. In the first place, a large number of agricultural labourers, say, 300,000 to 400,000, do not live in tied houses, and large numbers of these are

paying more in semi-suburban districts than the customary rural rent.

This brings me to the maximum deduction from wages which may be allowed for a tied house. Under the present system, are you going to get equal treatment as between the municipal and landowner builder? Can you say to the former that 7s. is a fair rent, but to the landowner that he can only charge 3s. for a similar adjacent house? That will have to be faced. Or, further, are you going to say to the local authorities that they should charge a different rent for similar houses, according to the occupation of the tenant? Local authorities will have to provide houses for agricultural, industrial, rural and semi-urban workers. Are they to charge the same rent to each class or are they to vary it according to the occupation of the tenant? They obviously could not limit their rents in semi-urban areas to 3s. weekly; but it is in fact clear that the rent of new houses must be much above the pre-war level. At the present moment agricultural labourers working on the same farm are often receiving different cash wages because they are charged a different rent, and as the deduction or payment for rent differs so the actual cash left to the labourer varies. Again, if more cottages had been available before the War they would in many instances have been let to agricultural labourers at more than 3s. rental. Lastly, if policemen, postmen, and other rural workers, are going to live in these new houses, the older and cheaper cottages will be available for the agricultural workers at a lower rental, although I do not want to limit agricultural labourers to these houses. We may, I think, safely say then that 3s. was neither the universal nor the maximum rent paid by the agricultural labourer before the War. Further, we cannot draw a strict line of demarcation between the various classes of occupiers of rural cottages when fixing rents for a group of identical houses.

I now want to say a word with reference to uneconomic rents. Let us take, for example, three labourers each paying an uneconomic rent. The first takes a tied house from the employer. In this case the employer is in fact paying a part of his rent. The man gets a larger wage than is apparent from the amount of his weekly earnings. The second labourer gets his house from the landowner. He is in this case subsidised by the landowner. The third labourer is the new type of case where the agricultural labourer rents his cottage from the local authority. If the landowner is able to point to a considerable

number of empty municipal cottages in a village near his land which are to be let at an uneconomic rent, either he is able to let his farm at a comparatively high rent without having to put capital into it by building cottages, as he had to build stables, byres, etc., or the farmer is relieved of the necessity of paying a sufficient wage to the workers to enable them to pay an economic rent. Here, if he gets an uneconomically rented house, it is the taxpayer and the ratepayer who are subsidising the labourer. It is important to notice this distinction. In cases (1) and (2) it is the private individual who is concerned. In case (3) it is the public. Whatever arguments there may be in favour of the farmer or the land-owner subsidising wages in the form of reduced rents, there can be no argument for the public doing so.

We are, therefore, faced with this fact, that all agricultural rents, where the houses are in good condition and have good accommodation, must go up, and, together with the initial rents for new houses built by local authorities, must be much higher than the figure customary in pre-war days. Reference to Note C below will show the sort of minimum rent which will have to be charged at the beginning if we are to get an economic rent later. On cottages costing £525 to £750, which are probably low figures, and assuming that one-third of the cost will be wiped off by the State grant, the economic rent to be charged later will vary up from at least 10s. to 15s. The cost is abnormally high now and I am afraid that we shall never get to pre-war costs, but I hope that when we arrive at the normal post-war conditions the present cost will have dropped by about one-third. This should be in about six or seven years. Meanwhile the Government will wipe off one-third of the present cost of building. That will be the contribution of the Treasury to meet the situation created by the War. That leaves the actual minimum figure on which an economic rent must be obtained as from £375 to £500, so that a rent of 10s. 8d. to 15s. 5d. per week, is the lowest economic rent to be hoped for in 1927 when we have normal conditions.

A fixed minimum of 7s. has been suggested as an initial rent for new rural cottages, but war experience has shown that a minimum tends to become a maximum, and such a low figure would be quite inadequate for industrial or semi-industrial districts. This is a serious objection to a cast-iron minimum which seems quite reasonable in itself.

The Government ideal is to arrive, later, at an economic rent, based on the cost of building in 1927, when they hope we shall have arrived at the post-war normal conditions, and when costs may have fallen by 30 per cent. Post-war rents must be a great deal higher than pre-war, and it is absolutely necessary to reconsider the figure of 3s. which is at present the maximum rent for a tied cottage. It will be impossible to say to local authorities that they should charge 7s. rent, and at the same time say to the private builder that he may only charge 3s. for an identical cottage in the same area. We must bear in mind the necessity for other houses in rural areas than those for agricultural workers, and we must consider the difficulty which local authorities would experience in attempting to let houses in the same area at different rents. In pre-war days the agricultural labourer would, in many cases, have been prepared to pay a higher rent for a better cottage. While the cost of living has doubled, agricultural wages have more than doubled. On the information available I do not think it would be unfair to say that the initial rent for an agricultural cottage should be at least 7s. to 10s. By this I do not mean that it is desirable that the rent of all the old cottages, many of which are far below our present standard, should go up to the same figure as for good new cottages. In 1927 it will be necessary to arrive at a very substantial increase and so in all probability there should be an intermediate rise on the proposed initial rents, say in about two or three years' time. The fact is that we must put rural housing on a commercial footing as soon as possible and get away from anything savouring of charity or subsidy. No industry can really exist without being placed upon a sound economic basis, and if the rural exodus and agricultural depression are to be checked we must get on to that basis as soon as possible.

* * * * *

Note A.—It is estimated that about 1,000,000 rural houses are occupied by the working classes, of which possibly 60 to 70 per cent., *i.e.*, 600,000 to 700,000, were occupied by persons solely employed in agriculture, and their families.

Need for New Cottages.—In 1913 the Land Inquiry estimated that 1,200,000 rural houses were occupied by working classes, and that an addition of 10 per cent. was needed to meet immediate housing requirements.

The Land Agents' Society regarded both these figures as over-estimates, and considered that 60,000 new cottages would be sufficient for agricultural workers.

Taking the middle of 90,000 between these two estimates and adding a further 10,000 for the increased need due to the cessation of building during the War, 100,000 might be taken as the present minimum requirement.

The Ministry of Health estimated that 500,000 new cottages were needed in the whole country. The population of rural areas is roughly one-fifth that of the whole country, so that on the basis of population the same figure of 100,000 would be indicated.

Tied Houses.—One-half to one-third of agricultural labourers inhabit tied houses (Land Inquiry).

So about 200,000 to 300,000 live in tied houses, and about 300,000 to 400,000 live in non-tied houses.

Possibly 75 per cent. of the tied houses are let at 3s. and 25 per cent. at 2s. 6d. or under. This is only a rough guess.

Note B.—The following counties had upwards of 30 per cent. of the male inhabitants engaged in agriculture in 1911:—

Montgomeryshire.
Radnorshire.
Huntingdonshire.
Cambridgeshire.
Lincolnshire.
Herefordshire.
Cardiganshire.
Suffolk.

Anglesey.
Norfolk.
Pembroke.
Dorsetshire.
Westmorland.
Oxfordshire.
Wiltshire.
Rutlandshire.

The proportion of the population overcrowded in the rural areas of these counties ranged in 1911 from 3 per cent. to 9·3 per cent., and, except in the case of Huntingdon, Westmorland and Rutland, was greater than the proportion overcrowded in the urban areas of the same counties, which varied from 1·9 per cent. to 6·2 per cent.

In all rural areas of England and Wales 61,000 tenements had more than two occupants per room, and half a million people were affected; roughly 6 per cent. of the population of rural areas.

Thirty-six per cent. of the population of rural areas lived over one but not over two per room.

N.B.—The term “overcrowded,” as used for the sake of convenience, refers to families in which more than two persons on an average occupy each room, including all living rooms. It does not allow for differences in the size of rooms or represent any opinion as to what does or does not constitute overcrowding, which must, of course, depend on a variety of other factors, such as the age and sex of the occupants.

Note C.—The cost of building, in town and country, is tending to approximate. A brick cottage of the type frequently

erected before the War, costing £350, would now cost at least £700. But local factors, such as the accessibility of materials, the nature of the site, etc., as well as the accommodation provided, affect the actual price.

There are some new methods of construction and some very old ones which appear to offer hopes of reduction in cost. Pisé de terre, cob and chalk may be suitable for some areas. Particulars of cost are not yet available, but it is thought that they should be substantially below brick.

Timber offers some advantages in speed of construction and price.

At the other end of the scale a number of quite new types of construction in concrete and steel, and concrete have been approved by the Ministry of Health. Some of these houses are capable of being produced in large numbers and rapidly erected. In many districts an economy of about £150 may be possible by use of these methods instead of brick.

Under the Housing (Additional Powers) Act just passed a subsidy of £150 will be paid to landowners, farmers or others erecting houses within 12 months for the working classes under certain simple conditions. In the cases of cottages built by local authorities the State is prepared to permit their sale on a basis of two-thirds of the cost of erection, and in calculating rents is prepared to wipe off one-third of the present cost of erection.

The probable cost of a rural cottage with standard accommodation will range from £500 to £750, so that either for the purpose of sale or for calculating the economic rent the cost of erection may be estimated roughly at from £350 to £500.

Assuming that the State bears the loss on one-third of the present cost of building, the economic rent of cottages of which two-thirds of the building cost was—

£350	would be	10/8	per week	(total cost	£525)
£400	"	12/3	"	(	" £600)
£450	"	14/-	"	(	" £675)
£500	"	15/5	"	(	" £750)

taking the rate of interest at 6 per cent. and the usual allowances for repairs, etc., in each case.

Note D.—Wages and Rents.—The special investigators appointed by the Board of Agriculture and Fisheries reported in December, 1918, that the average cash wages of the ordinary agricultural labourer were 16s. 9d. in 1914; this figure nearly agreed with those estimated by the Central Land Association and the Rural League in 1912-13.

The lowest minimum rate fixed by the Agricultural Wages Board is now 36s. 6d., and the highest 42s. 6d., so that the average must be above 37s.

The rise in the cost of living of rural workers was investigated by a special Committee appointed by the Agricultural Wages Board. Their conclusions were based mainly on the comparison of standard budgets and they explain that they cannot be regarded as in any way final. Their view was that in January, 1919, the cost of living had about doubled.

Adopting a similar method the Sumner Committee, appointed to inquire into the cost of living of the working classes generally, adopted a somewhat lower figure for June, 1918.

Without attaching to these figures a scientific accuracy which they do not claim, it may fairly be assumed that they are very near the truth and that, in fact, the cost of living of rural workers has roughly doubled since the outbreak of war.

During the same period rents have remained practically unchanged. The average shown by the Agricultural Wages Board Committee was 2s. 1d. in 1918, as compared with 1s. 11d. in 1914.

It appears to be difficult to resist the conclusion that the ordinary agricultural labourer, after meeting the increased cost of living, has more than the pre-war margin of cash to spend on rent. This is, of course, not an argument against the increase of wages that has taken place or against a further increase. The intention of the Corn Production Act was to give the labourer an increased standard of comfort. The first addition to his comfort that he needs is better housing; if the rise in the rate of wages has enabled him to pay a higher rent for a better house, it has achieved part of its purpose. It is agreed that the only permanent solution of the agricultural housing problem lies in the payment of an economic rent and in such wages as will make that payment possible.

SWEDES, TURNIPS AND MANGOLDS AT COCKLE PARK.

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VARIETIES OF SWEDES AND TURNIPS: THEIR COMPARATIVE VALUES.

THE county of Northumberland has taken an important place in the development of the culture of swedes and turnips in the north of England. J. Bailey and George Culley, in their work on the "Agriculture of Northumberland" (3rd edition, 1808), give a good account of turnip cultivation in the county at that time. They state that turnips were first grown for cattle feeding at Rock, near Alnwick, about 1730, and that their growth for this purpose quickly spread in the Lesbury district. The hoeing of this crop was first performed by skilled men of the gardening class, who received high wages, but the ordinary farm hands, including women, soon became quite good at this work. Craig of Arbigland, Dumfriesshire, drilled turnips in 1745, and in 1764 Dawson grew 100 acres drilled in ridges near Kelso. Matthew and George Culley migrated from Gainford, near Darlington, to Fenton, in Glendale, in 1767. George Culley, on his way from Fenton to a fair at Kelso, in that year first saw a field of drilled turnips, and was greatly impressed with the successful growth of this crop. The brothers Culley took Wark farm of 1,200 acres in 1786 at an annual rent of £800. This they cultivated with such marked success that as a result of their work and of increased prices the rent of this farm was increased to £3,200 in 1812. They and other pioneers developed the practice of drill husbandry in the cultivation of turnips. The raised turnip drill soon became known. Drilling was done much in the same manner as now, and the dung was enclosed in the drills. At first the drills were made 3 ft. wide, but it was soon found better to make them a width of only $2\frac{1}{2}$ ft. or rather less. The practice now in the north is to sow turnips on raised drills, about 27 in. wide. The cultivation of turnips for sheep and cattle feeding quickly developed. About 1755-80 the Swedish turnip was introduced into Scotland from Gothenburg, where they were known as "ruta бага." The Culleys and others took up their cultivation. It is interesting to note that they are still called "bagies" on Tweedside. By 1804 swedes were in general cultivation in the north of Northumberland. George Culley made careful

tests with rams and ewes of the comparative feeding values of turnips and swedes, and found that swedes had a considerably greater feeding value than turnips, that sheep required a much larger quantity of turnips than of swedes, and that swedes kept much better till the late winter and spring. An excellent account of the development of root growing in Northumberland is given by John Grey of Dilston, in the *Journal of the Royal Agricultural Society* for 1841.

For some years, trials designed to test the comparative values of different varieties of swedes and turnips have formed an important section of the field experiments carried out at Cockle Park, the Northumberland County Agricultural Experiment Station. The main object of the trials has been to compare the value of varieties on the basis of dry matter content of the crop, but the opportunity has also been taken to test variations in local cultural practice.

Before describing the experiments in detail it should be pointed out that the varieties of roots tested were classified as swedes, turnips, and soft turnips, the old term "yellow turnip" being discarded on the ground that several yellow turnips contain as much water as white or soft turnips, and should, therefore, be included under that heading.

The method of procedure adopted in carrying out the experiments was as follows: On a portion of the land set aside for the root crop two drills of each variety are sown at the rate of 3-4 lb. of seed per acre in the case of swedes, and $2\frac{1}{2}$ -3 lb. in the case of turnips. The swedes and turnips are all sown on the same date and the soft turnips later, but also all on the same day. The turnip seed is steeped in paraffin or turpentine for about 2 hours before sowing, with the object of keeping the fly from the seedlings for a short time after germination. The seed is dried in the sun or otherwise before sowing. Up to 1917 good farmyard manure was applied at the rate of 12 tons per acre, and since that year at the rate of 15 tons per acre. After being carefully topped and tailed the roots are weighed and samples are taken, 100 roots from each variety being cored at an angle of 45°. The cores from each variety are wrapped in waxed paper and sent to Armstrong College, where they are carefully analysed. The sampling and analytical work has been conducted with great care by Mr. S. H. Collins, M.Sc.

Time of Sowing Swedes and Turnips.—During the seven years 1907-13, the average date of sowing the swedes and turnips was 24th May, and during the four years 1915-18, 13th May.

It is interesting to note that the average dry matter per acre in the swede crops was 3·10 tons in the last four years, when earlier sowing was practised, as compared with only 2·29 tons in the first seven years. It should be mentioned, however, that in the later years the larger crops were to some extent due to an improvement in soil conditions. There is a tradition in the northern counties that swedes should not be sown later than about the middle of May, and this is certainly borne out by the results obtained at Cockle Park. It is not desirable to commence sowing swedes earlier than the last few days of April, as it has been shown at Cockle Park that a large proportion of the swedes sown early in that month "bolt" or "run to seed," probably because their growth in the early stages is interrupted by frost. On the other hand a careful study of the tables in the following pages will show the advantages of completing the sowing of swedes not later than the middle of May. If this is impossible it is then probably advantageous to substitute turnips for swedes. The tables conclusively show that swedes sown early will produce considerably more feeding material per acre than turnips sown at the same time, but that when swedes are sown late the feeding value of the turnips sown at the same time is equal, if not superior, to that of the swedes.

It has been the practice for the last two years at Cockle Park to plough the land for roots as deeply as possible in the previous autumn or early winter, and not to plough again in spring, but to complete the preparation by cultivation. This ensures that full advantage is taken of the good tilth resulting from the effect of the winter frosts, and a much better seed bed is obtained for the very small seeds of these crops, which are thus given a good start.

The soft turnips are usually not sown till some time in June. The object of including soft turnips in the trials is to enable farmers to judge how different varieties of these compare with each other. They are, of course, sown only on land on which it has been impossible to get swedes or turnips sown in good time.

It should be noted that the times of sowing apply to the northern counties. In the southern counties of England swedes are sown considerably later than in the north for reasons that need not be stated here.

Trials of Swedes and Turnips at East Learmouth, Berwick-on-Tweed.—In 1913 Messrs. Sutton & Sons, Reading, tested a very large number of swedes and turnips on Mr. Wm. Davidson's

farm at East Learmouth. Mr. Davidson arranged for all the varieties to be grown under exactly the same conditions, and on 12th November a large party of agriculturists inspected the trials. As one of the party the writer noted the good results given by the following swedes:—Caledonian (bronze top); Up-to-Date (bronze top); Champion (purple top); and Magnum Bonum (purple top). The appearance and apparent hardness of the Caledonian swede, which was then quite a new variety, were especially noteworthy, while the Favourite (purple top) Aberdeen turnip also attracted attention. It was decided to include all these varieties in the trials at Cockle Park, together with Early Sheepfold and Selected Fosterton, both green top yellow turnips which had also made good growth. It will be seen from the results given in the tables that the two last-mentioned varieties should be included among the soft turnips and not among the ordinary varieties.

It is satisfactory to note that in 1919 Mr. William Davidson obtained the £100 Victory Cup offered by Messrs. Sutton & Sons for the heaviest yield of swedes in the United Kingdom. The winning variety was Caledonian, which was found to weigh 58 tons an acre, this being 13 tons heavier than the crop of the next competitor. It will be seen from the tables that Caledonian swede has given the largest amount of feeding material per acre at Cockle Park in the years it has been tested.

Average Percentage of Dry Matter in Swedes.—The tests made from 1901–1919 gave an average result of about 12 per cent. dry matter in swedes. The amount varied from 10·32 per cent. in 1901 to 14·96 per cent. in 1904. This means that 20 cwt. of swedes in 1904 were about equal in feeding value to 29 cwt. in 1901. In summers when frosts occur on the grass at Cockle Park there are indications that the swedes are likely to be lower in dry matter than when such frosts are not prevalent.

The average amounts of dry matter in turnips and soft turnips are given in the tables.

TABLE I.—VARIETIES OF SWEDES AND TURNIPS, 1915–18.

Results per Acre.

	<i>Weight of Roots. Tons cwt.</i>	<i>Percentage of Dry Matter.</i>	<i>Weight of Dry Matter. Tons.</i>
<i>Swedes—</i>			
Average for eight varieties (4 years) ..	26 2½	12·05	3·10
<i>Turnips—</i>			
Average for five varieties (4 years) ..	26 19	9·95	2·67
<i>Soft Turnips (1915 and 1916)—</i>			
Average for five varieties (2 years) ..	25 12	8·46	2·19

TABLE II.—VARIETIES OF SWEDES AND TURNIPS, 1915-18.

Average Results per Acre for Four Years.*

Variety.	Weight of Roots. Tons cwt.	Percentage of Dry Matter.	Weight of Dry Matter. Tons.
<i>Swedes—</i>			
Darlington (bronze top)	24 15	12'40	3'05
Improved (bronze top)	26 8½	12'03	3'16
Caledonian (bronze top)	27 7½	12'34	3'36
Up-to-date (bronze top)	26 19½	11'83	3'17
Champion (purple top)	24 18½	12'15	3'01
Magnum Bonum (purple top)	26 6	11'65	3'03
New Buffalo (purple top)	25 11	12'02	3'06
Conqueror (bronze green top)	26 14½	11'97	2'94
<i>Turnips—</i>			
Green Top Aberdeen	24 10½	10'50	2'59
Perfection Green Top Aberdeen	25 5	10'08	2'55
Large Improved Green Top	29 4½	9'35	2'70
Purple Top Aberdeen	26 4½	10'01	2'63
Favourite Purple Top Aberdeen	29 10	9'78	2'89
<i>Soft Turnips (1915 and 1916)—</i>			
Early Sheepfold (green top yellow)	21 6½	8'92	1'89
Selected Posterton (green top yellow)	25 17½	9'15	2'54
Centenary (green top yellow)	26 12	7'68	2'03
Purple Top Mammoth (white)	28 3½	8'23	2'30
Pomeranian White Globe	26 0½	8'32	2'19

* Soft turnips only two years' average.

TABLE III.—VARIETIES OF SWEDES AND TURNIPS, 1907-13.

Average Results per Acre for Seven Years.

	Weight of Roots. Tons cwt.	Percentage of Dry Matter.	Weight of Dry Matter. Tons.
<i>Swedes—</i>			
Average for four varieties (7 years) ..	19 5½	11'90	2'29
<i>Turnips—</i>			
Average for six varieties (7 years) ..	24 18½	9'29	2'31
<i>Soft Turnips—</i>			
Average for three varieties (7 years) ..	21 8½	8'04	1'72

TABLE IV.—VARIETIES OF SWEDES AND TURNIPS, 1907-13.

Average Results per Acre for Seven Years.

Variety.	Weight of Roots. Tons cwt.	Percentage of Dry Matter.	Weight of Dry Matter. Tons.
<i>Swedes—</i>			
Darlington (bronze top)	19 16½	11'75	2'33
Improved (bronze top)	19 8½	11'95	2'33
Crimson King (purple top)	19 8½	11'81	2'30
Holborn Kangaroo (bronze top)	18 10	12'09	2'24
<i>Yellow Turnips—</i>			
Dale's Green Top	25 11½	8'90	2'28
All the Year Round	26 19½	8'52	2'30
Purple Top Aberdeen	24 19½	9'61	2'40
Green Top Aberdeen	22 19½	9'97	2'29
Mikado	24 8	9'29	2'26
Large Improved	24 13	9'44	2'33
<i>Soft Turnips—</i>			
Purple Top Mammoth	22 7½	8'04	1'80
Red Paragon	18 18	8'10	1'53
Centenary	22 19½	7'98	1'83

Summary of Results.—(1) When swedes and turnips are sown at the same time, between the end of April and the middle of May, the weight of dry matter in the resulting crop of turnips is 86 when that in the swede crop is taken as 100 (Tables I. and II.) When, however, swedes and turnips are sown under the same conditions later than the middle of May, this advantage for swedes disappears (Tables III. and IV.) Soft turnips are not sown till after it is too late to sow swedes and turnips. In respect of those sown at Cockle Park during June the figure for dry matter is 71, as compared with 100 for swedes sown in good time.

(2) The results of many feeding tests carried out at Cockle Park show that for cattle and sheep feeding the dry matter of swedes and turnips, and of different varieties of each, has practically an equal value. The relative food values of the various swedes, turnips, and soft turnips tested can, therefore, be judged from the dry matter figures given in the tables. Special attention is drawn to Table II., from which it will be seen that Caledonian (bronze top) swede has produced considerably more dry matter per acre than any of the other swedes; and that Favourite purple top Aberdeen turnip is highest in this respect among turnips. The results from these two varieties are not only the average best of the four years, but are also the best in respect of each of the four years.

(3) Throughout the trials the average percentages of dry matter were approximately as follows:—Swedes 12 per cent., turnips 9.6 per cent., soft turnips 8.25 per cent. This means that 20 cwt. of swedes, 25 cwt. of turnips, and 29 cwt. of soft turnips have practically the same feeding value.

(4) Three yellow turnips, Early Sheepfold, Selected Fosterton and Centenary, have yellow flesh of the same kind as ordinary turnips, but owing to their low content of dry matter they are grouped with soft turnips. It is believed that many farmers grow these varieties under the impression that they have the same feeding value ton for ton as ordinary turnips. It should be clearly understood that this is not so.

(5) The trials have shown that singling swedes 8 in. apart has given the heaviest crops, and that the drills should be kept as narrow as will permit of good cultivation during the growth of the crop. At Cockle Park the drills are usually 27 in. wide.

(6) The fact that the crops grown in the four years, 1915-18, were heavier than in the 7 years, 1907-13, is partly due to the

improvement of soil conditions brought about by the judicious growing of wild white clover and the application of basic slag.

(7) The varieties tested constitute only a few of those now on the market, but it is hoped that the results given will be helpful to farmers in making a suitable selection. It should be borne in mind, however, that the suitability of different varieties varies with soil and climate as well as other conditions.

(8) Attention is specially drawn to the figures in the tables giving the amounts of dry matter per acre produced by the different varieties. These figures are the truest indication of the value of a root crop to the farmer.

HOW MANGOLDS COMPARE WITH SWEDES AND TURNIPS.

Long-continued trials at Cockle Park show that mangolds do not mature so well in the northern as in the southern counties. They also indicate that the manuring for this crop must be much more liberal than that for swedes and turnips. At Cockle Park the seed is sown in drills 27 in. wide at the rate of 8 to 10 lb. per acre. It is previously steeped in water for 24 hours and then spread in the sun to dry before sowing; this practice hastens germination. The crop is usually sown between 21st April and 8th May. Earlier sowing gives an undue proportion of "bolted" plants, and later sowing is too late in the north for this crop. A considerable proportion of plants bolt, but it is better to allow this to happen than to run the risk of having a much smaller crop from late sowing. Mangolds have been grown year after year on the same land at Cockle Park, but quite good results have been obtained by growing them in rotation, alongside other roots. For the 3 years, 1917-19, about 27½ tons per acre of Prizewinner Yellow Globe mangolds have been produced. The average amount of dry matter contained in the crop was about 11 per cent., or about 3.02 tons per acre. This is approximately equal to the average content of swedes over the 4 years, 1915-18.

The following manuring per acre gave excellent results in these years: 12 tons dung, 2 cwt. sulphate of ammonia, 3 cwt. high-grade basic slag, and 2 cwt. common salt. The dung is spread in the drills, and all the artificials are applied on the top before the drills are split.

Mammoth Long Red mangolds have also been grown at Cockle Park. These have given about the same weight of roots per acre, but they have a higher dry-matter content (viz., 12.9 per cent.) than Prizewinner Yellow Globe mangolds, and have consequently produced considerably more dry matter

per acre. Long Red mangolds, however, are more difficult to remove from the ground, owing to the greater depth of the roots.

About $1\frac{1}{2}$ acres of mangolds are grown annually at Cockle Park, and are found of great value for ewes and lambs during the months of April and May. While mangolds are not quite so suitable for our northern climate as are swedes and turnips, their value for the purpose indicated and their keeping properties make them a very useful crop when a small area can be grown successfully.

Mr. H. C. Pawson has given much help in the preparation of this report.

INCUBATING STATIONS.

THE five Breeding or "Incubating" Stations which form part of the Ministry's Scheme for the Improvement of Poultry Stock were established in 1916 or 1917,* and the time has now arrived, therefore, when it is possible to review with advantage the results which have been obtained. The sites for the Stations were selected in the following counties:—

Anglesey, at Lledwigan, near Llangefni.

Carnarvon, at Madryn Castle Farm School, near Pwllheli.

Denbigh, at Lleweni Hall, Denbigh.

Cheshire, at Henhull Hall, Nantwich.

Cornwall, at Kernock, St. Mellion.

The main purpose of the Stations has been to distribute day-old chickens to small holders and cottagers, and, in addition, to supply applicants with sittings of eggs and stock birds from any surplus not required at the Station. Consistent with rendering the Station self-supporting the price of stock was fixed as low as possible, so as to encourage applications from poultry keepers who were unable to appreciate the value of better quality poultry.

The sites chosen were in districts in which this work would be likely to meet the greatest need and where facilities existed which allowed an economical arrangement to be made.

The Stations were placed under the supervision of the County Council Authorities, to whom a grant was made annually for the employment of an official to take charge of the work and to make any special arrangement which might be necessary

* Particulars of the Scheme and of the Incubating Stations were published in this *Journal*, April, 1916, p. 72, and October, 1916, pp. 685 and 702, and an account of the working of the scheme during 1917-18 in the issue for December, 1918, p. 1106.

as the work was developed. The management has been undertaken by women, who have proved themselves very capable in carrying out the work and especially in meeting many of the difficulties experienced in the early stages.

As the establishment of these Stations was of an experimental nature, the equipment provided was on a limited scale. Much of it, moreover, had already been previously utilised at other Centres for experimental purposes, and although adaptable for the purpose it was not the best type which could have been selected for the work.

The stock purchased for the Stations was from the very best laying strains, and the breeding pens were carefully mated. An important part of the Station work was to trap-nest the birds reared annually, in order to improve or maintain the quality of the stock at the Stations by selective breeding. The breeds chosen, White Wyandotte and White Leghorn, were considered the most suitable for general requirements, and only at one Station (Denbigh) was a third variety kept, *viz.*, Rhode Island Red.

Each Station consists of from two to three acres of land and the necessary buildings. From 80 to 100 adult birds are maintained for breeding purposes. These are penned in large grass runs each containing 10 or 12 hens and a male bird. A scratching-shed house fitted with trap-nests is provided for each run.

One half to two-thirds of the stock consists of pullets. Only the very best hens for breeding are retained after trap-nesting, and it has therefore been necessary to use the pullet stock for breeding. The stock hatched for retention, however, are from the more mature, tested birds, and the eggs and chicks distributed have, in the first instance, always been selected from the best pens.

Hatching has been carried out with small incubators with a total capacity at each Station of 600-800 eggs. Each year between 200 and 300 chickens are hatched and reared to provide stock for the Station, and from 800 to 1,200 day-old chickens for distribution in small lots to poultry keepers.

General Management.—The manageresses were single-handed until 1919, when the training of an assistant was in two cases undertaken. The work is responsible and exacting, entailing a considerable amount of advisory work, in addition to the entire manual work, management, and correspondence.

The success of the Station rests to a very large extent with the manageress, whose qualification must be of a specially high



FIG. 1.—A section of the Breeding Pens, Anglesey Station. The pen is occupied by young cockerels, while the breeding stock are on the stubbles.



FIG. 2.—Wyandotte and Leghorn Pullets, Anglesey Station.



FIG. 3.—The Rearing Ground and a corner of the Oat Stubbles, Anglesey Incubating Station.



order, since the methods employed are taken as a pattern for guidance to small poultry keepers in the county, and advice is sought by visitors and by correspondents on all matters relating to poultry.

Fresh male birds are introduced annually. Trap-nesting is carried out for six months in most cases, and has at times been continued for twelve months with special birds. The Station stock are hatched in March and April. The distribution of chickens commences in February and ends on or about 31st May. Sittings are distributed throughout the season and stock birds between June and October.

The food of the adult birds has in every instance consisted of wet mash and grain. In one case dry mash to supplement this food was used in addition, and the results were particularly good in this instance from the point of view of egg production.

Meat meal, or fish meal has been used in limited amounts, but no spice is given. Food is obtained through the ordinary channels and at no time have the Stations had any special advantage in this respect over other poultry keepers in the district.

Surplus eggs and birds fit only for table purposes have been disposed of in the local markets.

Anglesey Station.—The site at Lledwigan, at which the work was started in 1916, was unsuitable for a permanent Station, and the stock was transferred to a complete holding of $2\frac{1}{2}$ acres with a cottage within a mile and a half of the market town of Llangefni. Incubator and food rooms were added to the cottage.

The holding is very exposed to the heavy gales to which the Island is subject. The breeding pens occupy about three-quarters of an acre of ground, three-quarters of an acre is left for rearing in the spring and summer, and one acre is sown down to crops. Very good crops of oats have been obtained from this land in the last two years, and after harvest the birds have been turned out on to the ground.

The records of the birds—some of which have been published*—have been exceedingly good under the local conditions. Wyandottes have done better than the Leghorns, and it was at one time under consideration whether the latter breed should be dropped; a small proportion of Leghorns has been retained in the stock, however, as the demand for them is as large as for the Wyandottes, and the vigour of the stock should make them valuable under less severe conditions.

* See this *Journal*, December, 1918, p. 1106.

So keen is the demand for chicks and stock birds that although the supply to each applicant is strictly limited, applications for the whole of the output could be booked twelve months in advance.

The success of this Station has, without doubt, been due largely to the capable management of Miss Stanton, the manageress, and to the interest shown in her work by, and the practical support which she has received from, the Agricultural Organiser. Numbers of visitors call at the Station for advice, and there is much evidence of the value of the assistance given in the work which is being done in the county.

The produce disposed of from this Station in the four years since its formation in 1916 has been as follows :—

<i>Eggs for Hatching.</i>	<i>Chicks.</i>	<i>Stock Birds.</i>	<i>Produce for Table.</i>
1,824 ..	4,763 ..	461 ..	£157 7s. 3d. (3 years' figures.)

The normal capacity of the Stations can be reckoned only at 1,200 chicks and 100 stock birds annually for distribution.

Carnarvon Station.—This Station was unsuccessful, and the work was discontinued the second season.

Denbigh Station.—This Station was started at Llewenni Hall in 1917, two acres of land being given up to the poultry. At first the birds were all penned, but during late summer and autumn many of the birds were placed on free range on the farm. The land was very wet and the site badly placed for demonstration purposes and the despatch of produce. Very good work was done in 1918, but at the conclusion of the season it was deemed advisable to move to another site.

This Station is now situated a mile from Denbigh on a holding of three acres of very suitable land. A small cottage has been rented to provide an incubation room and office accommodation. Owing to the removal of the Station and the illness of the manageress, who eventually had to resign owing to ill health, little could be done in the way of distribution this year (1919), but the Station is in a good condition for work during the coming season.

Cheshire.—At this Station the poultry occupy less than 2 acres of ground enclosed with netting, and although located on a farm of 400 acres these advantages are of little value in the placing of the birds on free range, owing to the risk of losses from foxes.

The land is very wet, with a heavy soil, and although the pens have been moved to a fresh site, the conditions are not

good. Nevertheless, the records of the birds this season have been exceedingly good, and over 1,300 chickens and 85 adult birds have been distributed.

The stock raised during the year has proved vigorous, and the mortality has been very low. Careful records have been kept of the pedigree of the birds retained, and the Station is in a very good condition, owing very largely to the capable and thorough way the work is being carried out by the manageress, Miss Philipsen.

Cornwall.—At the commencement of the work the Station was under the great disadvantage of being seven miles from the railway and with no facilities for demonstration work. Excellent work was done at Kernock for two years, but in the latter part of 1918 the equipment was moved to Truro.

A field of $2\frac{1}{2}$ acres near the County Hall was rented for the purpose, and although to a certain extent the removal has meant a fresh start, with the usual disadvantages attendant on removals, the work has gone steadily on under the same manageress. 1,120 day-old chickens, 1,674 eggs for hatching and 40 stock birds have been distributed from the Station during 1919. The present position of the Station is very suitable for demonstration work, of which advantage is being taken, and Miss Watson, the manageress, has been able to extend the value of her work by visiting and giving practical lectures in the county. Miss Watson is now training an assistant in the work.

Useful evidence of the value of the stock is given by the trap-nest records, which show the averages for the flocks for the first six months of the year (commencing immediately after removal) as follows:—

Average for Leghorns (6 months) 134.2 eggs per bird.

„ Wyandottes (6 months) 116.4 „

The laying of the Leghorns was very consistent; the lowest score in the six months was 123, and only six birds failed to lay 130 eggs.

A drawback to the establishment of a complete holding for poultry on a small scale, such as is the case with these Incubating Stations, is the difficulty of finding holdings possessing suitable buildings. A substantial building is needed for incubation purposes, and good accommodation must be provided for the storage of food; the initial expense is, therefore, proportionately high.

Although these Stations have efficiently demonstrated the possibilities and methods of managing poultry on a small

holding where the necessary buildings exist, it would be a distinct advantage if they could be carried on in connection with a Farm Institute, where there would be better facilities for demonstration work, and the Station could be run more economically.

TITHE RENTCHARGE.

Redemption by an Annuity.—The Tithe Act, 1918, gave landowners who desire to redeem the tithe rentcharge on their land the option of paying the consideration either in cash or, under certain conditions, by means of an annuity. The amount of the annuity has to be calculated in the following manner. To interest not exceeding 5 per cent. per annum on the consideration money is to be added such sum as would be sufficient, if the periodical payments thereof were accumulated at compound interest at a rate not exceeding 4 per cent. per annum, to produce an amount equal to the consideration money at the end of the said period. The total of these two sums will give the amount of the yearly or half-yearly payment of the annuity as the case may be. In an average case the amount of the annuity for 50 years required under the Act to discharge the consideration for redemption of £100 tithe rentcharge, if attached to a benefice, would be about £104, and if not attached to a benefice, would be about £91. In this connection it may be noted that the sum payable under the Tithe Act, 1918, in respect of every £100 tithe rentcharge which becomes due on or before the 1st January, 1926 is £109 3s. 11d., and that after that date the sum payable is to vary from year to year in accordance with the average prices of wheat, barley and oats for the fifteen preceding years.

It is important to note that under the Tithe Act, 1918, the Minister's power to determine, on the sole application of the landowner, that the consideration for redemption shall be paid by an annuity, is limited to applications made on or before the 1st January, 1921. Henceforward the consent of the tithe owner to redemption by annuity, instead of by a cash payment, will also be necessary. Moreover, in some instances, landowners will doubtless find that their land forms part only of an area charged with tithe rentcharge, so that an altered apportionment will be necessary before an application for redemption can be lodged. In such cases application for altered apportionment

should be made forthwith. The proper forms and any instructions that may be necessary will be supplied, post free, on request to the Ministry at 3, St. James's Square, London, S.W. 1.

Compulsory Redemption.—When the tithes in kind were commuted into tithe rentcharge under the Tithe Act, 1836, and the amending Acts, a tithe rentcharge was in some parishes charged upon each field and in other parishes upon each farm. Since the commutation, however, lands in many parishes have become minutely sub-divided in ownership, either for building or other purposes, and in such cases the tithe owner has the right to call upon the owner of any part of the original field or farm as shown on the tithe map to pay the whole tithe rentcharge, leaving him the extremely difficult and expensive task of recovering from each of the other property owners concerned a due contribution towards the amount so paid. The most satisfactory course open to the property owner thus called upon to pay the entire rentcharge is to apply to the Minister for its compulsory redemption. The Minister assesses the total cost of redemption, including the redemption money and the official fees, among all the properties comprised in the site of the original field or farm, and collects the assessments from the owners of such properties so that each property owner is required to pay a fair share and no more.

Tithe owners also have the right in such cases where the land is minutely sub-divided to apply to the Minister for the compulsory redemption of the tithe rentcharge. They are also entitled to apply to the Minister for the compulsory redemption of any tithe rentcharge not exceeding 20s. charged on fields which have not become sub-divided.

One series of compulsory redemption cases now in progress affects 4,500 property owners in the district of Aston-juxta-Birmingham. The schedules of assessment of redemption money and expenses and the plans will in due course be deposited in the locality for the statutory period and twenty-one days for inspection by all persons interested. Any objections to the schedules will require to be heard and determined under Section 39 of the Tithe Act, 1860. As is usual in proceedings of this character, most of the objections will doubtless emanate from property owners who have been fortunate enough to escape payment of the tithe rentcharge altogether, their shares having been paid by one of the owners in the original field of which their property forms part, as owner who has not thought it worth while to go to the trouble to recover contributions toward the payment made by him.

The fact that they have thus escaped payment does not, however, exempt them from their liability to contribute to the cost of redemption.

The Custody of Documents relating to Tithes.—Lands in 11,787 parishes in England and Wales are subject to tithe rentcharge. The amount of this charge on any particular property may be ascertained by inspecting the tithe map and apportionment for the parish in the custody of the Ministry. Certified copies of each map and apportionment have been deposited in the parish, usually in the custody of the Incumbent and Churchwardens. Copies are also to be found in charge of the Registrar of the Diocese. The parish or Diocesan copies are open to inspection on payment of a charge of 2s. 6d. According to complaints which reach the Ministry from time to time, many of the parish copies of the apportionments and maps are in a worn and damaged state, while others have been entirely lost. This is no doubt due, partly to the practice of some custodians of unlawfully lending the documents out of their custody and partly to collectors of the tithe rentcharges being permitted to keep the documents, even in cases where they reside and carry on business out of the parish. Should a sealed copy of a tithe map or apportionment be in the possession of a person other than the persons legally entitled to hold it, any two Justices of the Peace for the County, or other jurisdiction within which the lands are situate, may, upon the application of any person interested in the lands or rentcharge, order the document to be removed from the custody of the person who unlawfully holds it and to be deposited in such other custody as the Justices may think fit, having reference to the security and the preservation of the document and to the convenience of the parties interested therein. Another means of dealing with cases where documents of this character are in unlawful custody is afforded by Section 17 (8) of the Local Government Act, 1894, which provides that Parish Councils may give directions as to the custody in which statutory parish copies of tithe apportionments and maps and of other tithe documents shall be deposited. This Sub-section further provides that the Incumbent and the Churchwardens on the one part and the Parish Council on the other are entitled to reasonable access to the documents, and any difference as to the custody or access is to be determined by the County Council.

Apportionment.—Where an estate charged with one tithe rentcharge is broken up and sold off in lots, it is often provided in the conditions of sale that the respective

purchasers shall pay the tithe rentcharge in accordance with an informal apportionment of the rentcharge made in connection with the sale. Landowners cannot, however, bind the owner of the tithe rentcharge by any such arrangement, nor would the consent of the owner of the rentcharge be sufficient in all cases to make the informal apportionment binding on all persons who may be the successors in title to the land and the rentcharges respectively. Where an informal apportionment is made, disputes and litigation not infrequently arise, particularly in cases where the lots are further sub-divided and resold. As a rule, the only effectual mode of apportioning tithe rentcharge is by means of an altered apportionment issued by the Minister, and, except in a few special cases, this can be done only if a landowner is willing to initiate the proceedings. The landowners concerned in any proposed altered apportionment may jointly employ an agent for the purpose of preparing a draft altered apportionment, and arrange for the payment of his remuneration and of the official fees. Alternatively, the applicant may request the Ministry to prepare the draft and to collect the costs by means of a rate levied on the other landowners concerned in such proportions as appear to be equitable. There is a widespread belief that proceedings for altered apportionment are troublesome and expensive. As a matter of fact, in cases where the Ministry is requested to prepare the draft and assess the costs, all that is necessary is that the applicant should send in his application on the usual form, together with a plan showing the properties into which the original estate has been subdivided, in which event the Ministry will do what is further necessary in the matter. In such cases the official fees work out on an average at about £18 per case, £1 per landowner, and 1s. 2d. per acre. The necessary forms of application and instructions may be obtained free of charge on request to the Ministry.

IMPORTS OF FOOD.

THE year 1919 may be regarded as transitional between the close of war conditions and the resettlement of trade on a peace foundation. Foreign and colonial markets are once more opening wider their doors to the British purchaser, and in the matter of food supplies the British farmer is again confronted with the prospect of increased competition from overseas. The returns relating to the agricultural imports and exports of the United Kingdom for the year 1919 contained in the Trade and Navigation Accounts recently issued by the Board of Trade* show the extent to which this trade has so far been able to recover as a result of the cessation of hostilities. The returns cannot, of course, be taken to represent the first year's working of trade under normal peace conditions. Trade restrictions and the enforcement of the German Blockade continued to some extent during the year, while as a special relief measure the Allied Governments made provision for supplies of food to be sent to meet the needs of starving Europe, which in times of more settled harvests might compete freely in international trading.

The total value of the principal articles of agricultural produce imported into the United Kingdom, as declared at the port of arrival, during the last seven years, was as follows:—

					£
1919	..	..	..	..	452,048,000
1918	..	..	..	..	423,822,000
1917	..	..	..	..	357,181,000
1916	..	..	..	..	305,493,000
1915	..	..	..	..	276,648,000
1914	..	..	..	..	211,591,000
1913	..	..	..	..	213,457,000

These figures represent the value of the grain and flour, meat and animals for food, butter, cheese, eggs, condensed milk, fruit and vegetables, hops, lard and margarine, which may be grouped together as agricultural products in the sense that they compete more or less directly with the products of the farmers of the United Kingdom.

The value of our imports during 1919 has thus increased 6·6 per cent. on the previous year, and 111·3 per cent. on 1913. While the figures for 1919 as to quantity may be said generally to show an increase over those for 1918, in a number of the main articles of import the increase is very small, while others show

* Obtainable from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, price 1s. 6d. net.

an appreciable decrease. Of the principal agricultural commodities, the imports in the total quantity of meat only increased 1·3 per cent. ; wheat and barley increased respectively 23·3 and 231·2 per cent. ; while oats decreased 38·9 per cent. Butter and cheese show slight decreases, but eggs increased substantially.

Total Imports of Meat.—The quantities and values of dead meat (excluding poultry and game) imported into this country during the last seven years were as follows :—

	Quantity.	Value.
	Cwt.	£
1919	25,561,099	173,893,874
1918	25,227,899	173,386,787
1917	19,573,552	101,617,443
1916	23,347,847	93,382,476
1915	25,276,030	86,151,234
1914	23,587,820	62,222,035
1913	23,278,230	55,309,358

The details for the years 1919, 1918 and 1913 are shown in the following table :—

Imports of Dead Meat.

Description.	Quantities.			Value.		
	1919.	1918.	1913.	1919.	1918.	1913.
	cwt.	cwt.	cwt.	£	£	£
Beef, fresh and re-						
frigerated	6,492,120	7,588,784	9,203,310	30,632,644	36,081,255	16,070,833
Beef, salted	68,990	14,682	49,834	454,345	97,812	111,070
Mutton fresh and re-						
frigerated	4,074,956	2,086,148	5,330,290	17,957,556	9,273,646	10,907,992
Pork, fresh and re-						
frigerated	136,189	99,654	494,264	899,975	685,973	1,368,360
Pork, salted	24,065	11,691	240,597	175,588	77,511	297,135
Baron	8,280,923	10,473,562	4,857,890	73,589,300	90,381,595	17,428,881
Hams	1,813,376	1,554,943	854,995	16,091,677	13,028,626	3,068,251
Meat, unenumerated,						
fresh and refrigerated	1,121,880	690,620	728,329	5,543,197	3,322,004	1,429,997
Salted	15,512	2,623	104,138	105,430	14,165	138,409
Meat, preserved	3,261,749	2,188,650	889,005	27,742,740	19,218,168	3,707,054
Rabbits	271,339	516,542	525,576	701,422	1,206,033	781,376
Total	25,561,099	25,227,899	23,278,230	173,893,874	173,386,787	55,309,358
Poultry.—						
Alive	Number.	Number.	Number.			
	619	101	858,979	386	96	37,923
Dead	cwt.	cwt.	cwt.			
	147,567	34,792	278,465	1,528,002	287,073	954,540
Game						
Alive	—	—	—	7,195	—	43,412
Dead	—	—	—	18,564	5,392	76,115

Beef.—No fresh beef has been imported since 1917.

Chilled Beef was imported in 1919 to the quantity of 125,504 cwt., as against 163,959 cwt. in the previous year, and 5,248,004 cwt. in 1913. With regard to value, the figures decreased from £771,137 in 1918 to £585,346 in 1919. The Argentine (123,804 cwt.) and Uruguay (1,700 cwt.) were the only countries of import ; the respective figures for these countries in 1913 were 5,216,022 cwt. and 31,982 cwt., when they also between them supplied the whole of the chilled beef imported.

With regard to imports of *frozen beef*, imports decreased from 7,424,825 cwt. in 1918 to 6,366,616 cwt. in 1919 in quantity, and £35,310,118 to £30,047,298 in value. The quantity and value of frozen beef imported during 1913 were, respectively, 3,952,880 cwt. and £6,278,793. The countries whence the beef was consigned were as follows:—

			1919.		1918.	
			<i>cwt.</i>	£	<i>cwt.</i>	£
Argentina			3,743,914	17,587,450	1,852,807	8,541,522
United States			856,170	4,715,681	3,583,549	18,213,746
Australia			622,307	2,487,164	547,660	1,969,461
New Zealand			424,735	1,771,322	388,382	1,341,316
Uruguay			307,284	1,423,602	186,411	847,892

The imports from the Argentine have doubled, while those from the United States have decreased by 76 per cent. It may be remarked that in 1913 the Argentine sent us half of our imports of frozen beef, and Australia one-third; the quantity received from the United States was inappreciable.

Mutton.—No *fresh or chilled* mutton has been imported during the last two years. The imports of *frozen mutton* rose from 2,086,148 cwt. in 1918 to 4,074,956 cwt. in 1919, or nearly 100 per cent.; the pre-war figure (1913) was 5,204,257 cwt. Thus the return of peace conditions has shown a rapid recovery in imports, approaching to the quantity received before the War. The respective values for 1919, 1918, and 1913 were £17,957,556, £9,273,646, and £10,583,930.

Our supplies were received mainly from New Zealand, the Argentine, and Australia, which in 1913 were also the principal countries of import.

Pork.—No *fresh or chilled* pork has been imported during the last three years.

Frozen pork was imported in 1913 to the quantity of 15,707 cwt. (value £43,255), and *salted pork* 240,597 cwt. (value £297,135). It should be mentioned, also, that in pre-war years Great Britain imported a considerable quantity of fresh pork, chiefly from the Netherlands, the total for 1913 being 478,557 cwt. America exported to us the bulk of our supplies of frozen and salted pork, although before the War Denmark was, in the latter commodity, by far our principal supplier. During the past few years, however, no imports were obtained from that country.

Bacon, Hams.—It will be seen from the above table that the figures for bacon and hams show a considerable increase over those for 1913.

The bulk of our supplies, both of bacon and hams, came from the United States. In regard to bacon, out of the 8,280,923 cwt. imported, the United States consigned 5,893,514 cwt. and Canada 2,094,248 cwt.; Denmark, which in 1913 sent us nearly half our supplies, during the past two years has exported to the United Kingdom an almost negligible quantity. While the importation of hams has increased so considerably, there has been little change in the markets of supply, the United States, as always, having sent us by far the largest quantity, with Canada as the only other country of any importance in this trade.

Rabbits.—271,339 cwt. of dead rabbits were imported during 1919, of which 270,491 cwt. were frozen, and 848 cwt. fresh. In the previous year the quantity was 516,542 cwt., all of it frozen. The pre-war figure (1913) was 481,964 cwt. frozen, and 43,614 cwt. fresh. Practically the whole of our supplies of frozen rabbits, as before the War, was received from Australia.

DAIRY PRODUCE AND EGGS.

Imports of Dairy Produce, Margarine and Eggs.

Description.	Quantities.			Value.		
	1919.	1918.	1913.	1919.	1918.	1913.
	cwt.	cwt.	cwt.	£	£	£
Butter	1,558,172	1,578,658	4,139,028	19,843,964	19,769,738	24,083,658
Margarine	459,369	301,650	1,518,297	2,229,838	1,563,405	3,917,701
Cheese	2,124,715	2,357,103	2,297,340	15,219,178	15,905,858	7,035,039
Milk, condensed—						
Unsweetened ..	1,033,385	900,696	50,008	4,087,168	3,495,768	89,984
Sweetened ..	2,150,535	1,666,994	1,202,207	11,835,076	9,035,173	2,095,437
	Great	Great	Great			
	hundreds.	hundreds.	hundreds.			
Eggs	5,644,395	2,656,415	21,579,950	8,613,326	4,621,649	9,590,602

Butter.—The figures in the above table show a practically stationary import trade, both in quantity and value, for the years 1919 and 1918, though a big drop on the pre-war figures. It is noteworthy that the bulk of the produce came from distant parts of the world, 318,872 cwt. being declared from New Zealand, 267,675 cwt. from the Argentine, 216,495 cwt. from the United States and 214,689 cwt. from Victoria. Denmark, which before the War was by far our principal country of import, sending us in 1913 no less than 1,706,759 cwt. (or more than the total quantity imported in 1919) only exported 290,291 cwt., a considerable increase, however, on the 1918 figure of 40,327 cwt. Russia exported 6,954 cwt. as against none in 1918 and 1917, but 751,414 cwt. in 1913, when she was the second largest country of import in this commodity.

Cheese.—The quantities of cheese imported recorded in the table above show very little drop as a result of war conditions, although in regard to value there is an increase of 116 per cent. between 1913 and 1919.

There was considerable change in the countries whence we receive our supplies. The New Zealand trade increased from 547,182 cwt. to 1,239,553 cwt., while a decrease from 1,293,768 cwt. to 647,212 cwt. is to be noted in the case of Canada, and from 22,449 cwt. to 19,856 cwt. in the case of the United States. The Netherlands figures show a decrease from 291,895 cwt. to 79,217 cwt. It may be stated that before the War Canada was easily the leading country of import, supplying us with more than half of our total imports, New Zealand being second and the Netherlands third.

Eggs.—The number of eggs imported during 1919 was 5,644,395 great hundreds, as against 2,656,415 great hundreds in 1918 and 21,579,950 great hundreds in 1913. The values of these quantities were declared, respectively, at £8,613,326, £4,621,649, and £9,590,602. The figures show that the importation of eggs, which decreased very con-

siderably as a result of war conditions, has shown a marked increase during the past year, although it is still a great deal below the pre-war quantity, while the cost to the British purchaser has not decreased to any very appreciable extent. The marked fall in our imports of eggs is perhaps due chiefly to the fact that Russia during the past two years has dropped entirely out of the trade. This fact will be better appreciated when it is pointed out that in 1913 Russia sent us nearly 11,453,277 great hundreds, or more than twice the number imported from all countries during 1919. A noticeable feature as regards the countries whence the eggs were consigned is the increase in the importation from North America, Canada exporting 1,476,962 great hundreds (388,985 great hundreds in 1918) and the United States 1,408,606 great hundreds (337,345 great hundreds in 1918). Denmark, however, is our principal supplier, sending us 1,638,067 great hundreds in 1919 as against 1,170,535 great hundreds in the previous year, but 4,265,000 great hundreds in 1913.

GRAIN AND MEAL.

Imports of Grain, Pulse and Meals.

Description.	Quantities.			Value.		
	1919.	1918.	1913.	1919.	1918.	1913.
	cwt.	cwt.	cwt.	£	£	£
Wheat	71,432,400	57,947,610	105,878,102	68,431,182	53,097,953	43,849,173
Wheat meal and flour	17,692,170	26,359,600	11,978,153	25,700,817	35,682,697	6,347,771
Barley	16,643,900	5,025,200	22,439,248	17,836,137	5,426,012	8,077,100
Oats	6,710,221	10,982,570	18,162,663	6,723,151	11,529,053	5,671,957
Peas	1,136,351	2,180,665	1,978,315	2,583,069	5,406,069	1,006,735
Beans (other than haricots)	730,975	438,511	1,540,405	875,150	641,782	568,189
Maize	16,860,900	14,490,177	49,154,953	13,722,033	13,678,534	13,769,793
Oatmeal	1,375,019	2,908,429	868,877	2,319,703	4,823,821	607,761
Maize meal	2,313,768	1,447,664	491,827	2,252,446	1,631,090	182,413
Other corn and meal	10,311,553	14,623,099	10,791,419	14,309,947	22,251,683	5,413,736
Total	145,207,257	136,403,525	225,283,962	154,753,635	154,168,694	85,494,628

Our supplies of wheat during 1919 were received principally from the United States (31,768,300 cwt.), Canada (17,857,800 cwt.), Australia (14,950,500 cwt.) and the Argentine (6,818,800 cwt.). Barley was received from the United States (10,793,200 cwt.) and Canada (4,830,200 cwt.); and oats from the United States (2,956,021 cwt.), and the Argentine (2,069,700 cwt.).

Maize was chiefly imported from the Argentine (13,914,800 cwt.), and *Beans* from China (526,690) cwt.

FRUIT AND VEGETABLES.

Fruit.—Raw fruit was imported to the value of £29,685,782 in 1919, as compared with £13,515,978 in 1918 and £11,625,979 in 1913. It is not possible to give the quantities which these values represent, but the following figures as to the quantities of certain kinds of fruit imported which may compete with the produce of the British farmer are of interest :—

	1919. cwt.	1918. cwt.	1913. cwt.
Apples	2,967,284	410,169	3,257,419
Pears	372,799	2,436	718,928
Plums	88,291	—	409,877
Cherries	19,121	50	62,267
Strawberries ..	35,831	—	15,040
Currants	52,531	1,981	108,691
Gooseberries ..	16,906	—	8,086

Vegetables.—*Import of Vegetables.*

	1919.	1918.	1913.
Potatoes, cwt.	988,879	1,015,793	9,427,316
Onions, bush. ..	6,931,635	4,342,586	9,105,164
Tomatoes, cwt.	1,306,368	516,412	1,582,986

The bulk of our supplies of potatoes came from the Channel Islands (744,963 cwt.), with the Netherlands second, and France third. The potato harvest in England and Wales in 1919 amounted to 2,733,000 tons, which, although 1,476,000 tons less than in 1918 (by far the largest crop recorded) is 50,000 tons more than the pre-war average.

The importation of hops recovered from 52 cwt. in 1918 to 154,453 cwt. in 1919, as against the 1913 figure of 262,184 cwt. The values were:—1919, £2,374,115; 1918, £210; and 1913, £1,753,003. The United States has remained the principal country of import. The total production of home-grown hops in 1919 amounted to 194,000 cwt., which is half as much again as that of last year, but only about less than half of the pre-war average.

CLOVER STEM-ROT.

(*Sclerotinia trifoliorum*, Erik.)

A. D. COTTON,

Mycologist to the Ministry of Agriculture and Fisheries.

THE fact that Red Clover, if grown repeatedly on the same land, suffers from "Clover Sickness" has been common knowledge for more than a century. For many years the nature of this malady was a matter of speculation, but the work of various investigators has shown that it is due to at least two distinct diseases, the one caused by the eelworm *Tylenchus devastatrix*, and the other by the fungus *Sclerotinia trifoliorum*. In spite of this, however, it is only quite recently that the symptoms of the two diseases have been generally recognised and the appropriate methods of treatment adopted.

The most recent work* shows that amongst leguminous crops species susceptible to one disease are not necessarily

* See Amos, A., *Jour. Roy. Agric. Soc. England*. Vol. 79, pp. 68–88.

susceptible to the other, and, *vice versa*, hence the extreme importance of correctly identifying the nature of the disease. The present article deals solely with the fungus disease now usually termed Clover Stem-rot and caused by the fungus *Sclerotinia trifoliorum*. The Clover Eelworm Disease is dealt with in Leaflet No. 46, issued by the Ministry.

Description of Clover Stem-rot.—Stem-rot attacks the clover plant in winter and spring, and causes a rotting of the leaves and shoots. If the attack is slight, the crowns may escape damage and later develop healthy growth, but in bad cases the fungus works down into the roots and completely kills the plants. In damp weather the disease spreads rapidly and in a short time destroys the foliage of whole fields; if dry or frosty weather prevails its progress is checked, but it is liable to renew its activity with the recurrence of suitable weather-conditions in spring or, indeed, at any time up to the cutting of the crop.

Careful inspection shows that Stem-rot usually commences in November. Spores of the fungus *Sclerotinia* are at that season abundant in the air and give rise to the disease. Having once gained a footing, the fungus, which appears externally as a sparse white mould, spreads readily over the foliage. The affected leaves and shoots are quickly destroyed and turn a characteristic olive-brown or yellowish-brown colour. Many separate spore-infections usually occur in any given area, but in addition to this, owing to the close proximity of the clover plants, the fungus easily spreads from one plant to another.

All the stems are not necessarily killed, and the shoots which escape injury, together with new buds from the crown, develop fresh growth in spring, though this is naturally rather weak. In bad cases, however, the fungus invades the roots and kills the plants outright; and when damp, muggy conditions prevail, and the land is thoroughly infested, very serious loss over an extensive area may occur.

Contamination of the Land.—The fungus perpetuates itself in the soil by means of resting bodies known as sclerotia. These bodies, which are formed chiefly early in the year and in spring, are hard, black in colour, and spherical or flattened in shape. The sclerotia occur chiefly around the collar of the plants or on the dead roots, and may be found 3 or 4 in. below the surface of the soil (see Fig. 1). They also occur in and on the stems, in which position their development may readily be traced. It will be seen that each arises as a dense, white, cushion-like growth which soon turns grey and finally becomes firm with a hard, black coat. Inside they are white and of the

texture of cheese. It is important to be able to recognise these bodies since they form one of the readiest methods of identifying the exact nature of the disease.

The sclerotia, when buried in the soil, are capable of retaining their vitality for a number of years. In any case they remain dormant during the summer after their production, but may germinate with the rains and cooler weather of late autumn and give rise to bodies producing spores. In order to germinate they have to be near the surface. Those that are deeply buried remain dormant and germinate at irregular intervals, as they are successively brought to the surface in the ordinary routine of farm cultivation.

On germination the sclerotia give rise to small, brownish pink, cup-shaped toadstools (*apothecia*) (see Figs. 2 and 3), which contain in their upper portions vast numbers of spores. In common with many fungi belonging to the same group, the apothecia when mature forcibly discharge their spores, which on a warm, sunny day are visible as minute clouds.

These spores alight on the foliage of the surrounding plants, and readily germinate, thus giving rise to the mycelium which produces the new infection.

Relative Susceptibility of Leguminous Crops.—The fungus *S. trifoliorum* attacks many kinds of leguminous plants, though with varying degrees of intensity. The following list is based on observations carried out in Cambridgeshire* :—

Common or Broad Red Clover.—Extremely susceptible.

Late-flowering Red Clover or Single-cut Cow-grass.—Very susceptible.

Lucerne.—Very susceptible during the first year, less so later.

Sainfoin.—Susceptible, especially the first year, occasionally severely attacked.

Trefoil.—Not often severely attacked.

Alsike or Swedish Clover.—Occasionally attacked, but not severely.

Dutch White Clover.—Occasionally attacked, but not severely.

It must be remembered that the above list refers exclusively to the Stem-rot Disease. The names of the varieties resistant to the Eelworm Disease will be found on p. 4 of Leaflet No. 46. Of other plants the disease is known to attack beans, but crops of peas and tares are apparently quite immune.

Distinction between Stem-rot and Eelworm Disease.—The leaves and shoots of plants attacked by *Stem-rot* die off rapidly in late autumn and winter and turn an olive-brown colour ;

* For further details see paper by A. Amos, referred to on p. 1241.

subsequently, the black sclerotia develop on the dead roots and stems. If the crown is not injured the plants may make new growth in spring and largely recover. Stem-rot is more or less regularly distributed over the fields, though certain portions may be more seriously affected than others.

In the case of *Eelworm Disease* the affected plants first turn pale in colour and the new growth is stunted, the stems being short and swollen and the leaves deformed. Diseased plants may live for some time, but they never recover, the foliage finally turning brown and the plants dying away. The Eelworm Disease commences from definite spots and spreads slowly but steadily outwards from these.

Control Measures.—In order to starve the fungus out of the land as completely as possible, an interval of at least 8 years, and preferably 12, should be allowed before sowing common red clover or late-flowering red clover (single-cut cow-grass) on infested land.

During this time the less susceptible crops, sainfoin, trefoil, alsike, or Dutch white clover should be substituted, either alone or with Italian rye-grass. Peas and tares may also safely be taken.

When red clover is next taken it should be sown in conjunction with Italian rye-grass or with alsike and trefoil.

It has been observed that red clover, if sown amongst wheat after beans, often becomes badly diseased. This sequence, therefore, should be avoided.

With regard to manures, further research is needed, but heavy dressings of organic and nitrogenous manures should be avoided, and an adequate supply of lime, potash and phosphates will tend to produce robust growth. On rich land subject to disease, grazing by sheep in September and October is of some value in reducing the thick foliage and so checking the rapid spread of the fungus.



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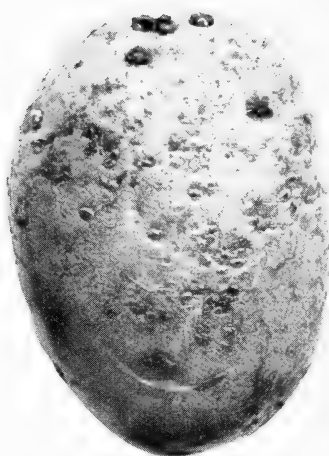
FIG. 1.—Drawing of dead Red Clover root in spring showing the black sclerotia at the collar and on the root.

FIG. 2.—Drawing showing the “toad-stool” like bodies (apothecia) produced from the sclerotia with the soil washed away. These fungi develop in late autumn and discharge spores which bring about new outbreaks of the disease.

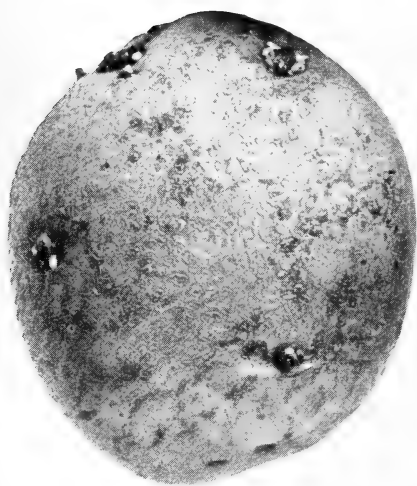
FIG. 3.—Photograph of a group of apothecia *in situ*. (For this photograph the Ministry is indebted to Mr. F. R. Petherbridge, M.A., of Cambridge University.)



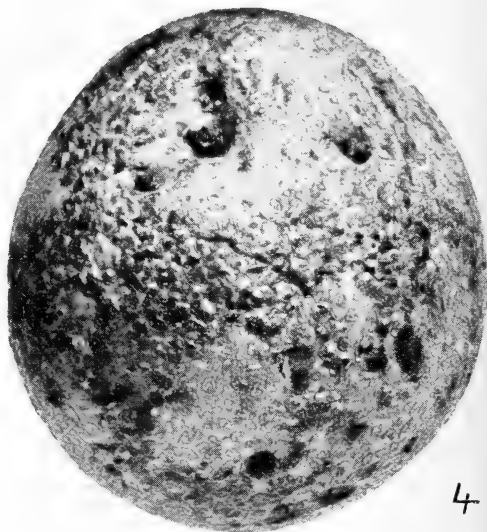
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Potato Tubers affected with Skin Spot. 1, 3, 4, Arran Chief ; 2, British Queen.

THE SKIN SPOT DISEASE OF POTATO TUBERS.

(*Oospora pustulans*.)

THE following is an abridged and slightly modified account of a paper by Miss M. N. Owen on the Skin Spot disease of potato tubers. The research was carried out in the Ministry's Laboratory for Plant Pathology at the Royal Botanic Gardens, Kew, and the original paper was published in the *Kew Bulletin of Miscellaneous Information*, No. 8, 1919. As this little-known disease appears to be on the increase, and as it is capable of causing considerable damage to the eyes of "seed" potatoes, it is thought advisable to reprint a portion of the article and one of the illustrations. For technical details the reader is referred to the full paper.

* * * * *

Introductory.—The disease known as Skin Spot is one of the minor diseases of potato tubers, and one which has never been thoroughly investigated. It is essentially a disease which develops in storage, a fact which probably accounts for its having been so long overlooked and so little understood. In certain seasons, however, Skin Spot is very abundant, and it appears to be becoming more prevalent than formerly. The affected tubers are dotted over with small dark spots, which are at times so numerous as to weaken or even to kill the eyes, and by disfigurement to lower the market value of the tubers.

In this article a description of the causal fungus, which proves to be a new species of the genus *Oospora*, is given, together with an account of its growth in pure culture, infection experiments, and notes as to the effects of the disease on the tubers. Although there is room for further work to be carried out with regard to the Skin Spot disease and the causes contributing to its development, it is thought that the results obtained should be placed on record, especially since no detailed account of the disease exists, and the identity of the fungus causing the disease was quite unknown.

External Appearance of the Disease.—The external characters of "Skin Spot," although not very striking, are quite distinctive, and there is not much likelihood of confusing it with other "spots." When a large number of potatoes are examined it becomes apparent that the spot may assume a some-

what different form according to the variety of potato on which it occurs. In the case of the coarser-skinned varieties, such as "Arran Chief," a definite pimple is developed, and the skin, which is never ruptured, is stretched tightly over the swelling, giving it a rather shiny appearance, which is most marked when a number of spots have arisen so close to one another that they coalesce. These swellings when dry are very similar in colour to the normal skin, but on being wetted stand out as a darker brown. In the case, however, of the thinner-skinned and smooth varieties, such as "King Edward," the diseased areas are rarely if ever raised, but consist of small sunken dark circular spots with a slightly raised centre, the area being brown or even black in colour. The latter agrees exactly with the description given by Pethybridge. These two forms have never been noted on one and the same tuber; intermediates, however, sometimes occur. In the case of both the pimple and the flat form, each affected area appears to be the result of individual and separate infection, and rarely extends for more than 1 mm. in diameter, or to a greater depth than 2 mm. It has been stated that the rose-end of the tuber is more liable to infection than the heel-end, but when a large number of specimens are examined this statement is not found to hold good. Very frequently, however, one side will be much more spotted than the other. Often the spots occur so close to one another that many of them merge, and thus extend over a considerable area, rendering the tuber very unsightly and injuring a considerable portion of the surface tissue.

A noteworthy point in connection with Skin Spot is the ease with which an entire spot or scab may be picked out. If removed with the point of a needle a white socket of sound potato tissue is usually left behind. The explanation of this is seen by means of a section, when it becomes apparent that the injured area is cuticularised and thus sharply isolated from the cellulose parenchyma of the flesh.

Microscopic Characters.—On sectioning one of these spots the hyphal threads of the invading fungus are plainly seen among the cells of the potato tissue which have become brown and dead. The filaments are exceedingly fine, 2–4 μ in diameter, hyaline or pale brown. The cell-walls appear to be somewhat thickened and cuticularised and to be lined with a brown substance, due probably to the decomposition of the cell-contents. The fungus penetrates below the periderm and invades the parenchyma, often to a depth of 12–15 cells.

The starch grains in the invaded cells entirely disappear. The progress of the fungus is apparently retarded by the cuticularisation of the cell walls, but attempts are also sometimes made on the part of the potato to form definite layers of cork below the affected part. In some cases successive layers of cork are formed. Early in April, when the fungus appears to be most vigorous, the hyphæ in the diseased cells are very numerous and for the most part hyaline; but later in the season, if similar areas are examined, very few hyphæ are found, and these are mostly brown, probably as the result of age. Judging from the smallness of the area which results from each infection, and from the fact that after a certain period of time the hyphæ, instead of penetrating to fresh cells, gradually die, the fungus can be regarded as only a very weak parasite on the potato tuber.

Pure Cultures of the Fungus.—In the article published in the *Kew Bulletin* there followed here an account of pure cultures of the fungus in the Laboratory and a discussion as to its systematic position. The fungus is named *Oospora pustulans*, Owen and Wakefield, and a technical description is supplied. An account is also given of the inoculation experiments carried out at Kew, where potato tubers were successfully inoculated with portions of the fungus grown in pure culture.

Possible Methods of Spread.—The following two sets of experiments were conducted in order to ascertain by what means the disease is carried from one season to another, and its method of spread in the soil.

The first set was carried out in pots. Clean tubers of "Midlothian Early," "Witch Hill," "British Queen," and "May Queen" were planted singly, at the end of April, in soil with which had been mixed peelings of diseased tubers. It was ascertained a few weeks later that the fungus was growing out from the inner side of the potato peelings, and was developing an abundant supply of spores. It is obvious, therefore, that the soil could easily be infected in this way.

The second series was conducted on the experimental ground at Kew, in a plot where the soil is a sticky silt. In order to test the possibility of the plants contaminating the soil a number of very badly infected tubers were planted in spring. The results showed that very little spread appears to take place during the first season, as on lifting in autumn, the crop was perfectly clean and no spots developed on the tubers during winter. It should be noted, however, that though the blotches or pimples produced by this fungus are sometimes ruptured under artificial

conditions, this does not take place naturally, so that in nature the fungus does not, perhaps, readily gain access to the soil, probably not until after the tubers decay. Should the soil be suitable for the fungus, in all probability tubers planted the following season would yield an infected crop.

Economic Importance of the Disease.—Since Skin Spot is a disease which develops in store and is not usually visible until the early spring, its economic importance might be expected to be slight. With regard to *ware* potatoes this is correct, for, as its name implies, the diseased areas are for the most part confined to the skin, and though the flesh of the tuber is penetrated to a slight extent by the fungus, it entails no appreciable waste in peeling. Beyond, therefore, rendering the tubers unsightly, and thus somewhat reducing their market value, this form of injury is not great.

In the case of *seed* potatoes, however, Skin Spot is of considerably more importance. When a crop in spring shows much infection, or the spots on the tubers are closely crowded together, there is a great danger of the eyes being injured. If the eyes are unaffected the shoots will grow and the plants will yield a normal healthy crop. This has been proved during two consecutive seasons at Kew. It should be remembered, however, that if the soil be suitable for the fungus it may become badly contaminated with the fungus, and future potato crops will be liable to suffer. On the other hand, where infection has taken place in the neighbourhood of the eyes, the eyes are definitely injured and even killed. Examination of tubers affected at the eyes shows that the fungus appears to penetrate, particularly deeply, the tissues around the eyes, and that in many cases relatively large areas of tissue may be killed. It has been observed by means of sections that the fungus at times not only kills the tissue around the eye, but also that immediately below it.

Although the primary eyes may be killed, it sometimes happens that secondary eyes may develop. Tubers of "King Edward," most of the eyes of which had been killed by *Oospora*, were placed in boxes to sprout in the usual way, and it was found that of the injured and killed eyes about 45 per cent. developed secondary eyes. Sections through some of these showed that the new buds had pushed their way through the dead tissue. This method of development has been described by Goebel* These new buds appeared to be fairly strong and

* Einleitung in die Experimentelle Morphologie der Pflanzen, 1908, pp. 221-222.

their production affords an explanation of a phenomenon noted when badly spotted tubers were planted at Kew, namely, that all the tubers developed strong plants. On account of the check at the start, however, the plants would be later, and the yield reduced. Though these secondary eyes are undoubtedly developed fairly frequently, many eyes are killed completely, and if it can be avoided it is highly undesirable to plant badly spotted tubers. It has been suggested that the development of Skin Spot is favoured by bad ventilation during storage, but from observations made in England last year it is clear that Skin Spot is often entirely absent in very badly ventilated clamps, and that it sometimes develops in pits where the ventilation is at all events quite up to the average.

The evidence at present available points to the fact that Scotch seed is more affected than English seed, but the question as to whether this is the result of more generally affected soil, the nature of the season, or the methods of storage, must remain over for a future investigation.

Summary.—The disease of potato tubers known as Skin Spot is caused by a fungus belonging to the Hyphomycetes. The fungus is not *Spicaria solani*, Harting, as has been previously thought, but a minute species hitherto undescribed, which appears most suitably placed in the genus *Oospora*, and is described as a new species *O. pustulans*. The fungus grows readily as a saprophyte in culture, including agar and gelatine media, but more freely on sterilised vegetable tissues. The morphological characters of the fungus as seen in artificial cultures are described in detail.

Field inoculations with spores of the fungus were successful in a certain number of cases in producing the spot on the tubers, and the fungus was re-isolated from the affected tubers. Further work on the life history of the fungus is required, as it is not certain whether the tubers are infected in the soil only or also during storage. The exact type of soil and the conditions under which Skin Spot develops with special virulence are not yet clear.

With regard to the injury caused by the disease, the fungus is confined to the surface layers, and is often sharply isolated from the mass of the flesh by a layer of cork cells. Tubers, however, may be so severely spotted as to be greatly disfigured and to be depreciated in value. In addition to this it is shown that previous suppositions with regard to the injury caused by the fungus to the eyes were correct. When infection takes place in the neighbourhood of the eyes these are weakened or

killed. In spite of the fact that in some cases secondary eyes are developed, seed tubers may undoubtedly be very seriously injured when the fungus is present in quantity. The only preventive measure which can be recommended at present is to avoid planting diseased tubers. If badly affected tubers are planted, not only are "misses" likely to occur, but the soil is likely to become seriously contaminated with Skin Spot fungus.

AGRICULTURE ABROAD.

On the basis of semi-official returns Professor Honcamp, of Rostock,* gives the following figures as to the consumption of artificial manures in Germany during twelve months just prior to the outbreak of war and twelve months ended shortly before the cessation of hostilities :

		<i>Phosphoric</i>	
	<i>Nitrogen.</i>	<i>Acid.</i>	<i>Potash.</i>
	(N).	(P ₂ O ₅).	(K ₂ O).
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
1st May, 1913 to 30th April, 1914	210,000	630,000	557,350
1st May, 1917 to 30th April, 1918	92,334	325,800	779,400

Calculated in pounds per acre (roughly 32,000,000 hectares, 80,000,000 acres, under cultivation in Germany 1913-14) these figures would work out :

					Phosphoric	
					Nitrogen. (N).	Acid. (P ₂ O ₅).
					(N).	(K ₂ O).
1913-14	..	..	..	..	5.84	17.5
1917-18	..	..	..	..	2.56	9.06

This would amount to an application in pounds per acre of total cultivated area of the following quantities of sulphate of ammonia (20 per cent. N.), superphosphate (18 per cent.) and kainit (13 per cent.) (or their equivalents—nitrate of soda, nitrolim etc. ; basic slag ; potash salts).

					Sulphate of Ammonia.	Super- phosphate.	Kaini
					lb.	lb.	lb.
1913-14	..	..	..	..	29.2	97.2	119
1917-18	..	..	..	..	12.8	50.3	167

* *Ueber Produktion Verbrauch und Bedarf an Pflanzennährstoffen.*
Fühling's Landw. Zeitung, 15/16 Heft, 1919, p. 282.

To the artificial manures must be added (1) farmyard manure, estimated before the War at 200,000,000 tons, with a content of 0.3 per cent. each of nitrogen and potash and 0.15 per cent. of phosphoric acid, and (2) green manuring, which, it is estimated, was ploughed in on about 800,000 acres.

The various amounts of plant food from the different manures give the following totals:—

Year 1913-14.				Nitrogen.	P ₂ O ₅	K ₂ O.
				Tons.	Tons.	Tons.
Farmyard manure	..	..	..	600,000	300,000	600,000
Green manuring	..	..	..	28,772	7,870	22,798
Artificials	..	..	..	210,000	630,000	557,350
				<u>838,772</u>	<u>937,870</u>	<u>1,180,148</u>

The writer points out that the chief anxiety of Germany for the future will centre round phosphates, the production of superphosphate depending entirely, and the production of basic slag to a considerable extent, on imports. In 1910 Germany's output of basic slag was 62.3 per cent. of the world's total. This, however, was only possible with a large import of, chiefly, phosphatic ores, the imports amounting to 11,000,000 tons of ore as against a home production of 23,000,000 tons.

An article in the *Frankfurter Zeitung** estimates the total nitrogen consumption of Germany in 1913 at 222,500 tons, of which amount Chilian nitrate contributed more than one half. Now that the Aniline Syndicate has decided to double its capital by an issue of shares to the value of 300,000,000 marks, it is calculated that the output of nitrogen by the Haber-Bosch process will reach 300,000 tons annually, which is more than the total consumption before the War. The addition of sulphate of ammonia and nitrate of lime opens up the prospect of an output of 400,000 to 500,000 tons.

The report of the Swedish War Food Committee estimates the total amount of animal manure produced in Sweden in the year 1912-13 at 22,612,105 tons. The manurial values assigned are, however, about half as much again as those given in the German estimate above. No allowance is made for green manuring, but, on the other hand, human manure is included.

* *Chimie et Industrie*, Vol. 3, No. 1, January, 1920, p. 138.

The following table sums up the total tonnage of plant food produced for the year in question :—

Production and Consumption of the various Plant-foods,
1912-13.

Kind of Manure.	Nitrogen.			Phosphoric Acid.			Potash.		
	Production.	Importation.	Consumption.	Production.	Importation.	Consumption.	Production.	Importation.	Consumption.
	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
Animal manure	100,836	—	100,836	51,156	—	51,156	117,745	—	117,745
Poudrette ..	333	—	333	166	—	166	133	—	133
Latrine ..	3,900	—	3,900	3,000	—	3,000	1,200	—	1,200
Artificial Manure..	2,017	4,081	6,098	3,515	28,891	32,406	—	19,668	19,668
Total ..	107,086	4,081	111,167	57,837	28,891	86,728	119,078	19,668	138,746

[NOTE.—The totals for animal manure, calculated on the same basis as Honcamp's figures above, work out respectively at Nitrogen and Potash, 67,836 tons, and phosphoric acid, 33,918 tons. This will reduce the three total consumption figures to nitrogen, 78,167 tons, phosphoric acid, 69,490 tons, and potash, 88,837 tons.]

(*Sv. Allmänna Landbrukssällskaps Medlemsblad*, No. 9, 1919.)

* * * * *

By a law of 31st October, 1919,* local authorities of the French departments and communes are empowered to acquire land for the purpose of re-selling in lots for labourers' cottages and small holdings.

Peasant Proprietorship in France.

The lots for labourers' cottages, including a garden, are not to exceed 10 ares ($\frac{1}{4}$ acre); small holdings of whatever area are not to exceed 10,000 francs (£400)† in value. The preamble defines the object of the law as being to facilitate the acquisition of small properties by labourers and by poor families, and it is provided that in disposing of the lots regard is to be had to the character of the applicants and the number of children. Further, preference is to be given to those who, for the purpose of purchase, have obtained long term credit from a recognised source. The land is to be offered at such a price that the local authorities neither gain nor lose on the transaction; the price is to be cash down. The conditions imposed upon the purchaser are that properties so acquired may not be disposed of for ten years, may not be used for other purposes, and, in the case of a small holding, that the land be cultivated by the holder himself or with the aid of members of his family.

* * * * *

* *Journal Officiel*, 1st November, 1919.

† Normal exchange.

In an article on a strike of farm-hands in the Province of Groningen, Holland, which lasted from the 5th May to the 21st July of last year, M. F. P. Lohnis* gives some interesting facts as to hours and conditions of labour in that part of Holland. In the north and south-east of the Province it is customary to work from 6 to 11.30 a.m. and from 1 to 5.30 p.m. In the intervening district (the Oldambt) work begins at 5 or 6 a.m., and is carried on until 1 or 2 p.m. Afterwards the labourer's time is at his own disposal. Many of the labourers are provided with a not inconsiderable piece of farm or garden land, for the working of which they are by local custom allowed the use of their employers' horses, and have certain other perquisites. They are thus able to keep a small amount of stock of their own, and are to some extent rather small holders than mere labourers.

* * * * *

A RECENT Belgian law on agricultural education, published in the *Moniteur Belge* of 1st December, takes the place of the law of 4th April, 1890. The new law

**Agricultural
Education in
Belgium.**

provides for two higher agricultural institutes, at one of which instruction shall be given in French, and at the other in Flemish. The Government system of agricultural training may also include the establishment of agricultural schools, both primary and secondary, and courses of teaching and lectures on agricultural and horticultural subjects. The Government may further, under certain conditions, subsidise agricultural and horticultural schools, courses and lectures, organised by communes, public bodies, or individuals. Hitherto the Belgian Government has only possessed one higher agricultural institute—that of Gembloux; apart from this all methods of instruction provided for in the new law would appear to have been in existence under the old. One of the most interesting features of the Belgian system are the lectures and courses of training on agricultural subjects, for which the Government agricultural experts (*Agronomes d'Etat*) are responsible. In the winter of 1910-11, courses of a varying number of lessons were given in 367 centres, and the average attendance at each lesson was 65. The lectures for farmers' wives in the same winter numbered 392, with an average attendance of 67. Another feature is the travelling school for

* *Tijdschrift der Nederlands. Heidemij.*, 1st February, 1920.

girls (Ecole ménagère ambulante) which gives training in the domestic side of farm life, including dairying. The school generally remains for about four months in one locality and then moves on to another. In the three years ended 1911 there were 79 sessions, attended by 1,372 pupils, of whom 1,221 obtained the final certificate.*

The Agricultural School of the University of Louvain was, before the War, a very important factor in Belgian agricultural education. It was not supported by Government funds.

* * * * *

A TABLE has been prepared, showing the number of live stock per 100 acres of cultivated land in the United Kingdom and other European countries. The total cattle per 100 acres in the United Kingdom is 25, as against 40 in Belgium, 38 in Holland, and 32 in Denmark. There are 9 dairy cows to the United Kingdom's 100 acres, as against 20 on a similar area in Belgium, 20 in Holland, 18 in Denmark, and 15 in Sweden. There are 8 pigs, as against 30 in Belgium, 23 in Holland, 21 in Denmark, and 26 in Germany. The number of goats in the United Kingdom is so small that it is not expressed in figures. Switzerland is said to keep 6 to the 100 acre, Germany 4, and Holland 4.

NOTICES OF BOOKS.

The Soil : an Introduction to the Scientific Study of the Growth of Crops.—Sir A. D. Hall, K.C.B., F.R.S. (London : John Murray, 1920, 7s. 6d. net). The third edition of this well-known standard work, recently published, is arranged on similar lines to the second edition, but the author states that after an interval of eleven years considerable revision has become necessary in a book dealing with a subject growing so rapidly as the science of the soil. During the period in question the chief addition to knowledge has been the extended light upon the organisms of the soil, and their functions gained through the Rothamsted investigations. The current views upon the structure of clay and many of the reactions of the soil in which the clay takes part have been considerably modified through the development of the conception of colloids which has taken place of late years. In many other instances it has been found necessary either to record some additional knowledge or to modify the point of view. The volume ends with a useful bibliography.

Food Supplies in Peace and War.—Sir R. Henry Rew, K.C.B., (London : Longmans, Green and Co., 1920, 6s. 6d. net). In this book

* *Situation de l'Enseignement Agricole. Rapport Triennal, Années 1909—1911, Bruxelles, 1913.*

Sir Henry Rew is mainly concerned with the condition of agriculture in Great Britain before, during, and after the War, from the point of view of the farmer and the outlook of the consumer. He compares very favourably the returns obtained from British agriculture with those recorded in respect of the principal countries on the Continent, and suggests that there are indications of a rapid recovery of agriculture in Europe, following on the disturbing effect of the War, and that in this recovery Great Britain will play no inconsiderable part. A chapter of some length on the State control of food supplies during the War, and a short concluding chapter on the personal factor in the agricultural industry, are likely to be of particular interest to some readers in view of the special qualifications of the author to speak on these subjects.

The Fungal Diseases of the Common Larch.—W. E. Hiley (Oxford: Clarendon Press, 1919, 12s. 6d.). The great value of the larch tree is known to all foresters, but its successful culture is always risky owing to its extreme susceptibility to disease, especially Larch Canker. Many investigations have been carried out in the past and much has been written, the bulk of which was useful and sound. The appearance of a new book on the subject is of special interest, the more so since it is the product of a well-known worker in the School of Forestry at Oxford, and embodies the results of a special and critical study.

The book covers the whole field of larch diseases, the dreaded canker, the heart-rot diseases which are the cause of unsuspected damage in apparently healthy trees, the Honey fungus and the leaf and seedling diseases. Much space is devoted to causes predisposing the plants to disease, and to cultural details. The chapters on canker deal with the canker fungus, its growth in the tissues, its mode of entry, the importance of wounds, and many other questions connected with the subject. Perhaps the most important paragraphs are those in which the author puts forward at length his views on the manner in which the trees are naturally infected by the fungus, namely, through the small dead lateral shoots. He is of opinion that the entry by means of wounds, though frequent, has in the past been over-estimated. The whole section on larch canker is of great importance and should be widely read.

Only second in interest are the chapters on heart-rots. These are dealt with in detail and provide by far the fullest account available in the English language. The most dangerous fungus of this group is *Fomes annosus*, which is well known to give special trouble on land planted with trees for the first time. A view previously put forward, and here elaborated by the author, namely, that poor aeration of the subsoil causes the death of the main anchor roots, thus laying them open to attack by *Fomes*, is discussed, and appropriate preventive measures are suggested. The general conclusion, however, is reached that trees other than larch are more suitable for first rotation on agricultural land. Chapters on the exceedingly destructive Honey fungus and on the seedling and leaf diseases are also given, and the work concludes with a general summary in which many cultural details are discussed.

The work, which is freely illustrated, is a valuable and important contribution to the literature of the subject. Its appearance is particularly opportune and should be carefully studied by all interested in the cultivation of the larch.

Syllabus of the Horace Plunkett Foundation Lectures on Rural Sociology.—A. W. Ashby (Institute for Research in Agricultural Economics, Parks Road, Oxford, 6d., post free). These lectures were delivered by Mr. A. W. Ashby at the Barnett House, Oxford, during the Michaelmas term, 1919. The course was intended to provide an introduction to the study of rural society and to general social conditions in agricultural districts. Although not primarily historical, the lectures deal with aspects of the history of rural life in England and Wales during the 19th century. The reading courses suggested in the pamphlet should be of value to outside students.

Report of the Army Cattle Committee.—Part II.—(London: H.M. Stationery Office, 1919. 2d. net.) The Committee appointed in 1917 to make arrangements for the purchase of cattle in the United Kingdom for the feeding of the Army during the latter months of the year 1917 have recently issued Part II. of their Report. The period during which the Committee were called upon to provide the troops in Great Britain with home-killed meat extended from 1st September, 1917, to December, 1917, and during this time 76,186 head of cattle were purchased and dispatched to the abattoirs. The object of the issue of Part II. of the Report is to give particulars of the purchases, including the number and weight of cattle dealt with and the expenditure incurred during the period of the work. In their concluding observations the Committee record that their methods of organisation of purchase throughout the country formed the basis of the rationing and control of live stock by the Ministry of Food, which was extended to all civilian supplies at the close of the Committee's operations.

Part I. of the Report, which was issued in 1918 (price 1s. net.), contains the statistical data which the Committee used as the basis of their action in the purchase of supplies. A number of tables of returns of cattle and meat production in this country, are given, and should be useful for purposes of reference to those interested in the subject.

Report of the Inter-Departmental Committee on Meat Supplies.—(London: H.M. Stationery Office, 1919. 3d. net.) The terms of reference of this Committee were "to consider and report on the means of securing sufficient meat supplies for the United Kingdom at reasonable prices, with special regard to the development of meat production in the United Kingdom, and to the protection of British markets and of producing countries within the Empire from domination by foreign organisations." This wide subject is dealt with under four headings: (1) the present situation, (2) the future production with regard to the United Kingdom, Oversea Dominions, and British meat companies in foreign countries, (3) distribution in the United Kingdom, and (4) general anti-trust measures. The Report concludes with a number of conclusions and recommendations.

Report of the Oversea Settlement Committee.—(London: H.M. Stationery Office, 1920. 3d. net.) This Report is for the year ended 31st December last, and deals with the question of settlement overseas within the Empire, and emigration to foreign countries. The Committee make a number of observations and recommendations with a view of enabling the Government to deal with the problems which are likely to arise during the present period of "reconstruction." Certain information contained in the Report may be of interest to intending land settlers from this country, although little matter is purely agricultural.

Allotments.—In reply to questions by Sir K. Wood, the Parliamentary Secretary to the Ministry of Agriculture stated that the Minister had power under Section 3 (1) of the Land Settlement (Facilities) Act, 1919, up to 1st August, 1922, when he was satisfied that in any county

Replies to Questions in Parliament affecting Agriculture, the council were not providing land to be leased to a parish council or a parish meeting

for the provision of allotments to such extent as in the opinion of the Ministry was desirable, to acquire land for the purpose. In the case of a borough council, other than a council of a county borough, an urban district council, or a parish council or meeting, if the Minister was satisfied after holding a local inquiry, that these councils and the County Council had failed to fulfil their statutory obligations to provide land for allotments, he might under Section 24 of the Smallholdings and Allotments Act, 1908, as amended by the Land Settlement (Facilities) Act, 1919 transfer the powers of the County Council to the Smallholdings Commissioners of the Ministry in order that the allotments required might be provided. Further, he was advised that there was no power under the Smallholdings and Allotments Act, 1908, or the Land Settlement (Facilities) Act, 1919, for the Minister or a County Council to act in default of the council of a county borough in regard to the provision of allotments. He went on to state that the details of the constitution of the Council of Agriculture for England, the Council of Agriculture for Wales, and the Agricultural Advisory Committee of England and Wales had not yet been finally settled. In the model scheme for the constitution of a County Agricultural Committee, recently issued to all County Councils, they were recommended to include on the committee representatives of allotment societies. If, in the case of any county, the interests of allotment holders did not appear to be sufficiently represented among the members appointed by the County Council, the Minister would endeavour to secure that adequate representation was given to such interests among the members of the committee, which he himself was empowered to give. (19th February, 1920.)

Agricultural Supplies to make the United Kingdom Self-Supporting.

—In reply to a question by Mr. Lambert, the Parliamentary Secretary to the Ministry of Agriculture stated that the acreage in the United Kingdom under wheat, barley, and oats, respectively, in 1919, was:—

	Acres.				
Wheat	2,370,000
Barley	1,870,000
Oats	5,117,000

[To render the United Kingdom self-supporting in cereals (excluding maize and other cereals not usually grown in this country) it was estimated that the area under the above cereals would have to be increased by about 10,700,000 acres, assuming average crops and a consumption (including seed and tail corn) at the level reached in 1919.

The number of cattle, sheep, and pigs in the United Kingdom in 1919 was:—

Cattle .. .. .	..	..	..	..	12,454,000
Sheep .. .. .	..	..	..	..	25,048,000
Pigs .. .. .	..	..	..	..	2,914,000

On the basis of the consumption in 1919 it was estimated that these numbers would have to be increased to the following extent in order to make the United Kingdom self-supporting in beef, veal, mutton, lamb, bacon and hams :—

Cattle	..	..	..	..	6,400,000
Sheep	..	..	..	..	18,900,000
Pigs	..	..	..	..	6,700,000

The estimated increase in the number of cattle includes an increase in cows and heifers sufficient to produce the milk required to make the country self-supporting as regards butter and cheese on the basis of the consumption in 1919. (4th March, 1920.)

Potatoes.—In reply to a question by Major Wheler whether potato growers might plant King Edwards, Arran Chief, and Up-to-date in clean and non-infected land in the coming season, the Parliamentary Secretary to the Ministry of Agriculture stated that he had ascertained in consultation with the Ministry of Food that there probably would be a shortage of home-grown potatoes prior to the 1920 crop becoming available, but that it is hoped to reduce the shortage as much as possible by importations from abroad. It was not possible at the present time to give any estimate of the 1920 crop, which would depend on the acreage planted and the weather conditions prevailing during the growing period. No alteration of the Wart Disease Order was contemplated which would affect in any way the varieties of potatoes planted during the coming season, but the Technical Advisers of the Ministry were giving careful consideration to the question of an alternative policy which might give certain concessions to the grower without endangering the further spread of the disease. (24th February, 1920.)

Consumption of Agricultural Produce.—In reply to a question by Mr. Lambert, the Parliamentary Secretary to the Ministry of Food stated that the estimated consumption by the United Kingdom during the year 1919 of wheat, barley, oats, beef, mutton, bacon, butter, and cheese was as stated in the following table :—

Commodity.	Estimated total Consumption.	Percentage of Home-grown and Imported Produce to Total.	
		Home-grown.	Imported.
	tons.	per cent.	per cent.
Wheat	7,395,000	27	73
Barley	1,956,000	64	36
Oats	4,297,000	92	8
Beef and Veal	995,000	66	34
Mutton and Lamb ..	368,000	57	43
Bacon and Hams	447,000	19	81
Butter	180,000	58	42
Cheese	145,000	30	70

NOTES.—*Cereals.*—The quantities are given after deduction for seed, and in the case of wheat, for tailings also.

Bacon.—The quantities given are for bacon as smoked or dried.

(16th February, 1920.)

Sulphate of Ammonia.—Replying to a question of Mr. Acland, the Parliamentary Secretary to the Ministry of Agriculture stated that under the existing arrangements the export of sulphate of ammonia was prohibited except under licence, and the price at which this material was sold by manufacturers and the Ministry of Agriculture and Fisheries. In regard to the future, the question was receiving the very close consideration of the Ministry with a view to securing adequate supplies of sulphate of ammonia and other fertilisers at reasonable prices after the close of the present season. (19th February 1920.)

Foot-and-Mouth Disease.—In reply to a question by Sir R. Cooper, the Parliamentary Secretary to the Ministry of Agriculture stated that there had been 28 initial outbreaks of invasion of Foot-and-Mouth Disease in England and Wales, from which 87 additional premises, contiguous or in the immediate vicinity, had become infected, making a total of 115 premises actually infected with the disease. With the exception of one case in Wales, all the outbreaks had occurred in England and Wales.

Each centre of initial invasion had been successfully eradicated and general dissemination of infection prevented. The Ministry's officers conducted a searching cross-examination of the owner and attendants of the affected animals with regard to each initial outbreak, but so far no connection had been traced. The spread of the disease to premises in the immediate vicinity of an initial outbreak had been traced to contaminated attendants, feeding stuffs, water, and to infected animals which changed hands before the Ministry's officers took charge. (3rd March, 1920.)

Waste Land Reclamation.—In reply to a question by Mr. Doyle, the Parliamentary Secretary to the Ministry of Agriculture stated that works were now being carried out for the reclamation of land in the neighbourhood of Wainfleet, on the northern shore of the Wash. Several schemes for the reclamation of land were prepared subsequent to the Armistice, with a view to finding employment for demobilised men. In view, however, of the urgent need for the curtailment of all public expenditure, it was recently decided that none of these schemes, other than that already referred to, should be proceeded with. (1st March, 1920.)

Live Stock.—In reply to a question by Brigadier-General Colvin, the Parliamentary Secretary to the Ministry of Agriculture stated that the Ministry were in constant communication with the Ministry of Food as to the slaughter of young stock, but in view of the comparative failure of the various Orders that had been made with the object of restricting slaughter it was considered undesirable to make any further Order of the kind at present. It was hoped that the situation would right itself when meat was decontrolled, but if not the matter would be further considered. (1st March, 1920.)

Tomato-growing.—In reply to a question by Mr. Gwynne, the Parliamentary Secretary to the Ministry of Agriculture stated that he could not agree that the tomato-growing industry was in any way overlooked by his Department. A grant was made to the Lea Valley Research Station, where many matters concerning the production of tomatoes were dealt with. The technical officers of the Department were fully qualified to deal with questions of culture, packing, grading

and marketing, and their advice on these matters was often sought. The question of obtaining statistics concerning the home production of tomatoes was engaging the attention of the Ministry, but the difficulties of obtaining data were very great. He understood that weekly returns of the imports of tomatoes could be obtained on application to the Commissioners of Customs and Excise. (3rd March, 1920.)

Potash Imports from Germany.—In reply to questions by Sir R. Cooper, the President of the Board of Trade stated that no import licences were required for the importation into this country of potash from Germany. Certain quantities of potash salts had been received from Germany by His Majesty's Government as part payment for food supplied to Germany. They were taken over from the British Government by the British Potash Company for resale under the authority of the Potash Distribution Committee, which was set up to regulate the prices and conditions of sale. Maximum prices to consumers had been fixed, and the profits of the British Potash Company were limited to 1 per cent. of the gross turnover of the contract plus one-third of any further profit, the remaining two-thirds reverting to the Government.

He further stated that he did not know anything about the commercial importation of potash. No import licences were required, but in so far as we receive such potash in payment from Germany the British Government is bringing it in. (16th February 1920.)

THE monthly crop report of the Ministry on 1st March was as follows:—The mild and generally dry weather of February was very favourable for field work, but in some districts **Agricultural Conditions in England and Wales on 1st March.** in the north and west ploughing was checked by rains. On the whole, however, very good progress was made with cultivation, and this work is much more forward than is usual at the beginning of March.

Spring sowing has been begun early and large areas have already been sown in the south and east. Autumn-sown crops have improved and, except for beans in some districts, are forward. Wheat is healthy and vigorous and a full plant, and winter oats and beans are very promising. It is estimated that there has been a considerable falling off in the area sown with wheat up to 1st March as compared with the area sown at the corresponding date last year. Probably from one-fourth to one-third of the wheat will need a top-dressing in the spring.

Seeds are very variable; where there is a good plant the crop has done well, but thin crops are common in practically all districts, and many fields have been ploughed up.

Ewes are in very fair condition. In the south-west, where lambing is now general, the fall of lambs is satisfactory, and losses have been few. In other parts of the country lambing in general is only just beginning, but so far the fall of lambs has been about the average and prospects are favourable.

The mild weather has been beneficial to live stock, and they have improved during February in some districts, though they are frequently in poor condition. Keep is still scarce but is lasting out better than was anticipated.

There is practically no change in the labour situation. In nearly all districts there are sufficient men available, but many are unskilled, and more trained horsemen and cattlemen are required.

Prices of Ground Basic Slag.—In consideration of the increase in the cost of production, and of the higher railway rates which have now to be paid on the raw materials, fuel, bags,

Official Notices. etc., the Ministry has authorised basic slag makers to withdraw the rebates of 2s., 3s., and 4s. per ton previously allowed for deliveries made during March, April, and May, respectively.

The agreed maximum prices for ground basic slag delivered in March, April and May, 1920, will, therefore, be the same as those ruling from 1st September, 1919, to 29th February, 1920. In all other respects the prices and conditions of sale announced in the notice F.P. 493/S.1* remain in force until 31st May, 1920.

Advisory Committee on Steam Cultivation and Threshing.—The Rt. Hon. the Lord Lee of Fareham, G.B.E., K.C.B., Minister of Agriculture and Fisheries, has appointed a Standing Committee to advise the Ministry on all questions affecting the steam cultivation and steam threshing industries in England and Wales. The Committee will be constituted as follows: Mr. H. L. French, O.B.E., one of the Assistant Secretaries of the Ministry (*Chairman*); Mr. John Allen, O.B.E. (*Vice-Chairman*); Mr. A. M. Cole; Mr. F. M. Elgar; Mr. Pearce Ellis; Mr. James Falconer, M.B.E.; Mr. Percy Grundy; Mr. J. N. C. Bay, and Mr. George Thurlow.

The Secretary of the Committee is Mr. C. S. Good (Ministry of Agriculture and Fisheries, 72, Victoria Street, S.W. 1), to whom all communications should be addressed.

Foot-and-Mouth Disease.—Since the issue of last month's *Journal*, outbreaks of Foot-and-Mouth Disease have been confirmed in two fresh centres, namely:—

Gloucestershire and Worcestershire.—The first outbreak in this District was confirmed on the 12th February at Leckhampton, near Cheltenham. The usual Order prohibiting the movement of animals over a wide area was issued on the same day. These restrictions have been considerably modified. Unfortunately, on the 27th February, an outbreak occurred on premises at Ripple, near Tewkesbury, about 15 miles to the north of Leckhampton, which necessitated the re-imposition of the entire prohibition of movement over an area covering a radius of about seven miles around these premises. No further outbreaks in this District have occurred since that date.

* See this *Journal*, June, 1919, p. 337.

Oxfordshire and Buckinghamshire.—On the 15th February Foot-and-Mouth Disease was confirmed on four separate premises in this District, namely :—two near Thame (Oxon), one at Bicester (Oxon), and one at Luggershall (Bucks). Further outbreaks were confirmed on the 18th February, near Bicester (Oxon), on the 21st February at Luggershall, on the 22nd February at Wendover (Bucks), on the 23rd February at Merton (Oxon), on the 26th February at Summertown (Oxon), and on the 27th February near Wendover (Bucks), making ten outbreaks in all in this District to date. It has been ascertained that all these outbreaks are connected with one another, but no origin has been discovered for the initial case. The usual Order prohibiting the movement of animals was issued on Sunday, the 15th February. These restrictions have since been modified as regards the Outer parts of the Scheduled District.

All restrictions on the movement of animals imposed in connection with the outbreaks in Bedfordshire, Northumberland, Flintshire, Lancashire, and Wiltshire have been withdrawn, and the restrictions in Devonshire have been reduced to a very small area around Bow.

Rabies.—The only events worthy of mention during the past month are as follows :—A case of Rabies was confirmed (on the 18th February) in a dog which was in quarantine on veterinary premises at Hersham, Surrey. This dog had been placed in quarantine on account of its having been bitten by the rabid dog condemned in the case confirmed at Addlestone on the 13th January.

The extent of the area subject to the Orders of the Minister relating to the muzzling and control of dogs in South Wales was considerably reduced as from the 10th March, and the more stringent restrictions applicable to the Inner Controlled Area apply only to two small Areas in the neighbourhood of Cardiff and Bridgend.

January Journal: Errata.—On p. 997, lines 8 and 9, in the passage in the article on Warble Fly describing the most effectual method of exterminating the insects, for "beginning early in May and continuing during June, July, and August," read "beginning in February or March, and continuing during April, May and June."

Fig. 2 illustrates the fully-grown state of the maggot, and the reference on p. 996, line 28, should, therefore, be transferred to line 33.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Martin, J. N.—Botany for Agricultural Students. (First Edition). (585 pp.) New York: J. Wiley & Sons; London: Chapman & Hall, 1919. 12s. 6d. net. [58(02).]

England and Wales, Memoirs of the Geological Survey.—Explanation of Sheet 154: The Geology of the Country around Lichfield. (302 pp.) London, 1919. 9s. net. [55: 912.]

Harper Adams Agricultural College.—Present Day Difficulties in Agricultural Production. (4 pp.) [Paper read before the Shropshire Chamber of Agriculture, November 29th, 1919.] [63.604(2).]

University of Leeds.—No. 109:—Ploughing out of Grass Land. (27 pp.) Leeds, 1919. [63.191.]

Sowerby, J. E., and Johnson, C. P.—British Wild Flowers. (168 pp. + 1600 figures in colours.) London: J. E. Sowerby, Mead Place Lambeth, 1860. [58.19.]

Field Crops—

University of Leeds.—No. 112 :—Report on Tests of Varieties of Wheat, 1916-1919. (16 pp.) Leeds, 1919. [63.311(04).]

Hoagland, D. R.—Relation of Nutrient Solution to Composition and Reaction of Cell Sap of Barley. (8 pp.) (Reprinted for private circulation from the "Botanical Gazette," Vol. lxviii., No. 4. October, 1919.) [63.113.]

Horticulture—

Spain, Ministerio de Fomento, Minas y Montes.—La poda de los agrios (The Pruning of Orchards). (16 pp.) Madrid, 1919. [63.41-195.]

Plant Diseases—

India Board of Agriculture.—Proceedings of the Second Meeting of Mycological Workers in India, 1919. (68 pp.) Calcutta, 1919. 1s. net. [63.292(54).]

Live Stock—

Barton, F. T.—The Cottager's Pig. (63 pp.) London: Jarrolds, 1919. 2s. 6d. [63.64(02).]

Powell, E. J.—History of the Smithfield Club from 1798 to 1900. (168 pp.) London: Smithfield Club, 1902. [63.70(06).]

Pearl, Raymond.—The Seasonal Distribution of Swine Breeding. [Reprinted from "The Scientific Monthly," September, 1918. (pp. 244 to 251.)] [63.64(04).]

Dairying and Food, General—

Starling, E. H.—The Feeding of Nations: A Study in Applied Physiology. (146 pp.) London: Longmans, Green & Co., 1919. 5s. net. [31: 612.39.]

Canada Department of Agriculture.—Report of the Proceedings of Dominion Dairy Conference held at Ottawa, 25th-28th November, 1918. (115 pp.) Ottawa, 1919. [63.70(06).]

Veterinary Science

University of Leeds.—No. 111 :—Contagious Abortion in Cows. (4 pp.) Leeds, 1919. [619.2(a).]

Birds, Poultry and Bees—

University of Leeds.—No. 110 :—Poultry Keeping. (15 pp.) Leeds, 1919. [63.651(04).]

Brown, E. T.—Ducks, Geese and Turkeys. (123 pp.) [Smallholder Library, No. 13.] London: C. A. Pearson, 1918. 1s. 6d. net. [63.657; 63.652; 63.658.]

Forestry—

Somerville, W.—Some Problems of Re-afforestation. (13 pp.) London: John Murray, 1919. 6d. net. [63.49(04).]

Engineering—

Clayton, C. H. J.—Land Drainage from Field to Sea. (192 pp.) London: Offices of "Country Life," 1919. 6s. net. [63.14(02).]

History of the Navigation of the Port of King's Lynn and of Cambridge; also the History and the Present State of Draining in the Bedford Level. Illustrated with Maps. (148 pp.) London: L. Davis & C. Reymers, 1766. [63.14(02).]

Economics—

Spain, Ministerio de Fomento.—Estatuto de la Mutualidad Nacional del Seguro Agropecuario. (16 pp.) Madrid, 1919. [368.5.]

Hibbard, B. H.—Effects of the Great War upon Agriculture in the United States and Great Britain. (232 pp.) New York and London: Oxford University Press, 1919. [63(73); 63(08).]

Eve, Sir H. Trustram.—State Control and Agriculture. (113-151 pp.) ["Journal of Farmers' Club," December, 1919.] 6d. net. [338.99.]

Selley, E.—Village Trade Unions in Two Centuries. (183 pp.) London: George Allen & Unwin, 1919. 4s. 6d. net. [331.]

SELECTED CONTENTS OF PERIODICALS.

Horticulture—

Les Plantes médicinales à Valenciennes, *Ardouin-Dumazet*. (Jour. d'Agric. Prat., 7th August, 1919.) [63.348.]

Über die Zusammensetzung von Gemüse und Gemüseabfall, *M. F. von Schleinitz*. (Landw. Jahrb., LII. Bd., Hefte 2 & 5, 1918.) [63.51(04).]

Plant Diseases—

Burgundy Mixtures and other Copper Sprays, *G. T. Spinks*. (Ann. Rep. Agric. and Hort. Research Sta., Long Ashton, 1918.) [63.295.]

Silver Leaf Disease, III. (Including Observations upon the Injection of Trees with Antiseptics), *F. T. Brooks* and *M. A. Barley*. (Jour. Agric. Sci., September, 1919.) [63.24-41.]

Silver Leaf Disease, *J. Bininer* (Roy. Bot. Gard., Kew, Bull. Nos. 6 and 7, 1919.) [63.24-41.]

The Fungicidal Properties of Certain Spray-fluids, II, *J. V. Eyre*, *E. S. Salmon* and *L. R. Wormald*. (Jour. Agric. Sci., September, 1919.) [63.295.]

Skin Spot Disease of Potato Tubers (caused by *Oospora pustulans*), *M. Nest Owen*. (Roy. Bot. Gard., Kew, Bull. No. 8, 1919.) [63.24.]

Note on Striped Pine Caterpillar (*Trachea piniperda*). (Tijd. Ned. Heidemaatschappij, October, 1919.) [63.27.]

Versuche mit Saatschutzmitteln, *H. C. Müller* and *E. Molz*. (Landw. Jahrb., LII. Bd., Heft 1, 1918.) [63.294.]

The Anatomy of the Head and Mouth Parts of *Psylla mali*, the Apple Sucker, *A. J. Grove*. (Parasitology, October, 1919.) [63.27.]

Rhizoctonia Disease, or Stem Rot, on Potatoes, *D. G. O'Brien*. (Scott. Jour. Agric., October, 1919.) [63.24.]

A Dry Method of Treating Seed Wheat for Bunt, *G. P. Darnell Smith* and *H. Ross*. (Agric. Gaz., N.S. Wales, October, 1919.) [63.24.]

Live Stock—

Über Chenopodiaceen als Nahrungsmittel, besonders über die als Melden bekannten Arten von *Chenopodium* und *Atriplex*. Ein Betrag zur Frage der Verwendung der peruanischen Reismelde, *Chenopodium Quinoa*, *Dr. F. W. Bach*. (Landw. Jahrb., LII. Bd., Heft 3, 1918.) [63.259; 63.604(a).]

The Nutritive Value of Feeding Stuffs, *J. Alan Murray*. (Science Progress, October, 1919.) [612.394.]

Problems of Animal Breeding, *J. A. S. Watson*. (Scott. Jour. Agric., October, 1919.) [63.603.]

Scottish Pure-Bred Live Stock. I.—Aberdeen-Angus Cattle, *James R. Barclay*. (Scott. Jour. Agric., October, 1919.) [63.62.]

The Use of Poppy Seed Cake as a Cattle Food and its Effect on Yield of Milk and Composition of the Butter Fat, *H. E. Annett* and *J. N. Seu*. (Jour. Agric. Sci., October, 1919.) [63.604(a).]

Die Kunitliche Trocknung und Verfütterung der Brennessel, *O. Fischmann*. (Deutsche Landw. Presse, 20th August, 1919.) [63.604(a).]

Sesbania—A Feeding Stuff from South Africa. (Bull. Imp. Inst., Vol. XVII., No. 2, April-June, 1919.) [63.604(a).]

The Seed-Crushing Industry, *J. W. Pearson*. (Jour. Roy. Soc. Arts, 12th December, 1919.) [63.604(a); 664.3.]

Die Strohaufschliessung nach dem Beckmannschen Verfahren. I.—Einfluss der Aufschliessungszeit auf den Umfang der Nährwerterschliessung. *G. Fingerling* and *K. Schmidt*. (Land. Versuchs-Stationen, Band XCIV., Heft 3 and 4, 1919.) [63.604(a).]

Engineering—

Pöhl Motorpflüge. (Deutsche Landw. Presse, 27th August, 1919.) [63.175.]

Hand Broadcasting Machine, *Hoffmann*. (Deutsche Landw. Presse, 29th October, 1919.) [63.17(04).]

Economics—

Zur Entwicklung der Landarbeiterlöhne in Preussen, *Dr. W. Asmis*. (Landw. Jahrb. LII. Band, Heft 4, 1919.) [331.]

Costs of Production and Horse Labour, *H. W. Carlton*. (Jour. Land Agents' Soc., November, 1919.) [338.58.]

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Articles or reports on the following subjects have appeared in the *Journal* each month or from time to time, and are not separately indexed :—Notes on Feeding Stuffs, Notes on Manures, Notes on Crop Prospects and Live Stock Abroad, Notes on Agriculture Abroad, Notes on the Weather, Notes on Agricultural Labour in England and Wales, Notes on Agricultural Conditions in England and Wales, Prices of Agricultural Produce, Outbreaks under the Diseases of Animals Acts, Lists of Additions to the Ministry's Library, and Selected Contents of Periodicals.

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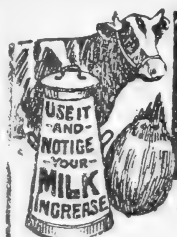
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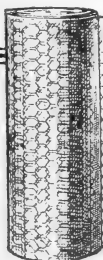
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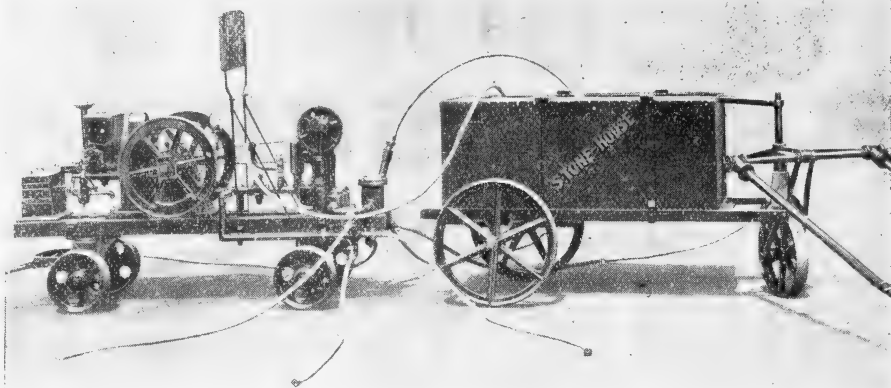
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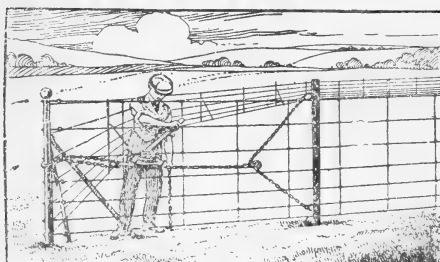
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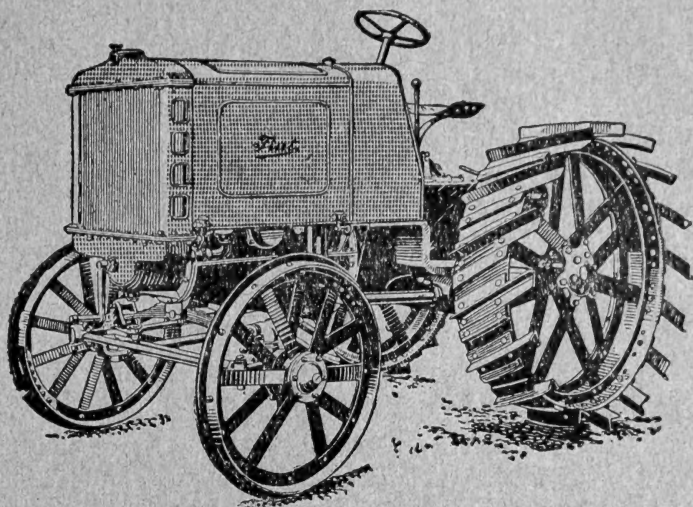
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